A

HISTORY

OF

THE EARTH,

AND

ANIMATED NATURE.

By OLIVER GOLDSMITH.

ILLUSTRATED WITH COPPER PLATES.

A NEW EDITION,

WITH CORRECTIONS AND ADDITIONS,

BY W. TURTON, M. D.

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CONTENTS

OF THE SIXTH VOLUME.

OF INSECTS. PART II.

CHAP.		PAGE.
I.	Of the second Order of Insects . . .	1
II.	Of the Libella, or Dragon-fly . . .	2
III.	Of the Formica Leo, or Lion-ant . .	7
IV.	Of the Grasshopper, the Locust, the Cicada, the Cricket, and the Mole Cricket .	13
V.	Of the Earwig, the Froth Insect, and some others, belonging to the second Order of Insects	31
VI.	Of the Ephemera	36

OF INSECTS. PART III.

I.	Of Caterpillars in General	45
II.	Of the Transformation of the Caterpillar into its corresponding Butterfly, or Moth .	48
III.	Of Butterflies and Moths . . .	67
IV.	Of the Enemies of the Caterpillar . .	75
V.	Of the Silk Worm	79

OF INSECTS. PART IV.

I.	Of the fourth Order of Insects . . .	91
II.	Of the Bee	92
III.	Of the Wasp	115
IV.	Of the Ichneumon-fly	127
V.	Of the Ant	130
VI.	Of the Beetle, and its Varieties	142
VII.	Of the Gnat, and Tipula	159
VIII.	Of the Gad-fly	164

CONTENTS.

Of ZOOPHYTES.

CHAP.		PAGE.
I.	Of Zoophytes in General	169
II.	Of Worms	172
III.	Of the Star-fish	180
IV.	Of the Polypus	183
V.	Of the Lythophytes and Sponges	193

A

HISTORY

OF

INSECTS.

CHAP. I.

Of the Second Order of Insects.

IN the former part we gave a concise history of the most considerable insects that, without wings, were produced in a perfect state; either from the body of the parent alive, like quadrupeds, or from the egg, in the manner of birds. We come now to a second order of insects, that are produced from the egg, like the former, but not in a perfect state; for when first excluded, they are without wings. This, however, does not hinder the exercise of their animal functions; the insect, although not yet come to perfection, walks, leaps, and eats; nor is it ever deprived of motion, only that it rests a little when it is about to cast that part of its skin previous to its state of perfection. It is then seen to assume two wings, which, like a budding flower, burst through the case that contained them, and the animal becomes a winged insect in its state of highest perfection. To this order we may refer the Libella, or Dragon-Fly;

the Formica Leo, or Lion-Ant; the Grasshopper; the Locust; the Cricket; the Wood-Cricket; the Mole-Cricket; the Flea-Locust; the Flying-Bug; the Tipula; the Water-Scorpion; the Notonecta, or Water-Fly; and many others.

CHAP. II.

Of the Libella, or Dragon-Fly.

OF all the flies which adorn or diversify the face of Nature, these are the most various and the most beautiful; they are of all colours, green, blue, crimson, scarlet, white; some unite a variety of the most vivid tints, and exhibit in one animal more different shades than are to be found in the rainbow. They are called, in different parts of the kingdom, by different names; but none can be at a loss to know them, as they are distinguished from all other flies, by the length of their bodies, by the largeness of their eyes, and the beautiful transparency of their wings, which are four in number. They are seen in summer flying with great rapidity near every hedge, and by every running brook; they sometimes settle on the leaves of plants, and sometimes keep for hours together on the wing.

Dragon-flies, though there are three or four different kinds, yet agree in the most striking parts of their history, and one account may serve for all. The largest sort are generally found from two to three inches long; their tail is forked; their body divided into eleven rings; their eyes are large, horny, and transparent, divided by a number of intersections; and their wings, that always lie flat

when they are at rest, are of a beautiful glossy transparency; sometimes shining like silver, and sometimes glistening like gold. Within the mouth are to be seen two teeth covered with a beautiful lip: with these the creatures bite fiercely when they are taken; but their bite is perfectly harmless, as I have experienced more than once.

These insects, beautiful as they are, are produced from eggs, which are deposited in the water, where they remain for some time without seeming life or motion. They are ejected by the female into the water in clusters, like a bunch of grapes, where they sink to the bottom by their natural weight, and continue in that state till the young ones find strength enough to break the shell, and to separate from each other. The form in which they first shew life is that of a worm with six legs, bearing a strong resemblance to the dragon-fly in its winged state, except that the wings are yet concealed within a sheath peculiar to this animal. The rudiments of these appear in bunches on the back, within which the wings are folded up into each other, while all the colours and varieties of painting appear transparent through the skin. These animals, upon quitting the egg, still continue in the water, where they creep and swim, but do not move swiftly. They have likewise a sharp sight, and immediately sink to the bottom, if any one comes to the places wherein they live, or whenever they perceive the least uncommon object. Their food at that time is soft mud, and the glutinous earthy substances that are found at the bottom.

When these animals prepare to change from their reptile to their flying state, they then move out of the

water to a dry place; as into grass; to pieces of wood, stone, or any thing else they meet with. They there firmly fix their acute claws; and, for a short time, continue quite immoveable, as if meditating on the change they are to undergo. It is then observed, that the skin first opens on the head and back; and out of this opening they exhibit their real head and eyes, and at length their six legs; whilst, in the mean time, the hollow and empty skin, or slough of their legs, remains firmly fixed in its place. After this, the enclosed creature creeps forward by degrees; and by this means draws first its wings, and then its body out of the skin; and proceeding a little farther, sits at rest for some time, as if immoveable. During this time the wings, which were moist and folded, begin by degrees to expand themselves, and to make smooth and even all those plaits which were laid against each other, like a closed fan. The body is likewise insensibly extended, until all the limbs have obtained their proper size and dimensions. All these surprising and difficult operations are accomplished by the force of the blood and the circulating humours. The creature cannot at first make use of its new wings, and therefore is forced to stay in the same place until all its limbs are dried by the circumambient air. It soon, however, begins to enter upon a more noble life than it had hitherto led in the bottom of the brook; and from creeping slowly and living accidentally, it now wings the air, and makes choice from amidst the variety of provisions.*

[* During this grub-state of the animal, it preys with the most savage ferocity on all aquatic insects. It is, likewise, at this period, furnished with an apparatus at the end of the body, by which it can suck up and eject water with considerable force.

Indeed, no animal is more amply fitted for motion, subsistence, and enjoyment. As it haunts and seeks after its food flying in the air, Nature has provided it with two large eyes, which make almost the whole head, and which resemble glittering mother-of-pearl. It has also four expansive silver-coloured wings, with which, as with oars, it can turn itself with prodigious velocity; and to assist these it is furnished with a very long body, which, like a rudder, directs its motions. As the wings are long, and the legs short, they seldom walk, but are ever seen either resting or flying. For this reason, they always chuse dry branches of trees or shrubs to remain on; and when they have refreshed themselves a little, they renew their flight. Thus they are seen, adorning the summer with a profusion of beauty, lightly traversing the air in a thousand directions, and expanding the most beautiful colours to the sun. The garden, the forest, the hedges, and the rivulets, are animated by their sports; and there are few who have been brought up in the country, who have not employed a part of their childhood in the pursuit.

But while these beautiful flies appear to us so idly and innocently employed, they are in fact the greatest tyrants of the insect tribe; and, like the hawk among birds, are only hovering up and down to seize their prey. They are the strongest and the most courageous of all winged insects; nor is there one, how large soever, that they will not attack and devour. The blue fly, the bee, the wasp, and the hornet, make their constant prey; and even the butterfly, that spreads so large a wing, is often caught, and treated without mercy. Their appetite seems to know no bounds;

they spend the whole day in the pursuit, and have been seen to devour three times their own size in the capture of a single hour. They seize their prey flying with their six claws, and tear it easily to pieces with their teeth, which are capable of inflicting troublesome wounds.

But the males are upon the wing for another purpose beside that of food, as they are very salacious, and seek the females with great ardour. The sun no sooner begins to warm the fields, than the males are found assiduously employed each in seeking its mate; and no sooner does a female appear, but two or three males are seen pursuing and endeavouring to seize her with all their arts and agility. The instrument of generation in the male is placed very different from that of any other insect, being not at the end of the tail as in others, but immediately under the breast, and consequently, at first view, incapable of being united to the sexual part of the female; which, as in other insects, lies in the tail. To perform this junction, Nature has provided the male with a very peculiar manner of proceeding. As ſoon as he perceives the female, and finds himself sufficiently near, he seizes upon the back of her head by surprize, and fastening his claws upon her, turns round his forky tail, which he fastens round her neck and in this manner fixes himself so closely and firmly, that no efforts can remove him. It is in vain that she flies from one branch to another and settles upon them, he still keeps fixed, and often continues in this situation for three or four hours successively. When he flies, she is obliged to fly with him; but he still directs the way; and though she moves her wings, she seems entirely guided by

his motion. As yet, however, the business of impregnation is not performed; for to this the female must contribute; and she at last seems, by the continuance of her constraint, to comply: for, turning up the end of her tail to that part of the breast of the male in which lies the part proper for generation, both instruments meet, and the eggs of the female receive the necessary fecundation. An hour or two after this, she flies to some neighbouring pool, where she deposits her eggs, as was already mentioned. There they continue in a reptile state for a year; and then are changed into a beautiful fly, resembling the parent.

CHAP. III.

Of the Formica Leo, or Lion-Ant.

ALTHOUGH this animal properly belongs to no order of insects, yet, as it is changed into a fly very much resembling that described in the preceding chapter, it may not be improper to give its history here. If we consider the life of this animal in its different stages of existence, we shall find it equally wonderful in all; but as it changes to a dragon-fly, what we have said of that animal above need not be repeated here. The lion-ant, when it becomes an inhabitant of air, in every respect resembles that which has been already described; its glossy wings, its voracious appetites, its peculiar manner of generation, are entirely the same. It is in its reptile state that it differs from all other insects; and in that state it will be amusing to pursue its history.

The Lion-Ant, in its reptile state, is of the size of

a common wood-louse, but somewhat broader. It has a pretty long head and a roundish body, which becomes a little narrower towards the tail. The colour is a dirty grey, speckled with black, and the body is composed of several flat rings, which slip one upon another. It has six feet, four of which are fixed to the breast and two to the neck. The head is small and flat, and before there are two little smooth horns and feelers, which are hard, about a quarter of an inch long, and crooked at the ends. At the basis of the feelers there are two small black lively eyes, by which it can see the smallest object, as is easily discovered by its starting from every thing that approaches.

To a form so unpromising, and so ill provided for the purposes of rapacity, this animal unites the most ravenous appetites in nature; but to mark its imbecility still stronger, as other animals have wings or feet to enable them to advance towards their prey, the lion-ant is unprovided with such assistance from either. It has legs indeed; but these only enable it to run backward, so that it could as soon die as make the smallest progressive motion. Thus, famished and rapacious as it ever seems, its prey must come to it, or rather into the snare provided for it, or the insidious assassin must starve.

But Nature, that has denied it strength or swiftness, has given it an equivalent in cunning, so that no animal fares more sumptuously, without ever stirring from its retreat. For this purpose, it chuses a dry sandy place, at the foot of a wall, or under some shelter, in order to preserve its machinations from the rain. The driest and most sandy spot is the most proper for it; because a heavy clogged earth

would defeat its labour. When it goes about to dig the hole where it takes its prey, it begins to bend the hinder part of its body, which is pointed, and thus works backward; making, after several attempts, a circular furrow, which serves to mark out the size of the hole it intends making, as the ancients marked out the limits of a city with a plough. Within this first furrow it digs a second; then a third; and afterwards others, which are always less than the preceding. Then it begins to deepen its hole, sinking lower and lower into the sand, which it throws with its horns, or feelers, towards the edges, as we see men throw up sand in a gravel-pit. Thus, by repeating its labours all round, the sand is thrown up in a circle about the edge of the pit, until the whole is quite completed. This hole is always formed in a perfect circle; and the pit itself resembles the inside of an inverted funnel. When this insect first leaves the egg and is newly hatched, the first pit it makes it very small; but as it grows bigger, it makes a larger hole; which is destined like a pit-fall, to entrap its prey. It is generally about two inches deep, and as much in diameter.

The work being thus with great labour finished, the insidious insect places itself in ambush, hiding itself in the bottom under the sand in such a manner, that its two horns encircle the bottom of the pit. All the sides of this pit-fall are made of the most loose and crumbling materials; so that scarce any insect can climb up that has once got down to the bottom. Conscious of this, the lion-ant remains in patient expectation, ready to profit by that accident which throws some heedless little animal into his den. If then, by misfortune, an ant, a wood-louse, or

a small caterpillar walks too near the edge of the precipice, the sand gives way beneath them, and they fall to the bottom of the pit, where they meet inevitable destruction. The fall of a single grain of sand gives the murderer notice at the bottom of its cave; and it never fails to sally forth to seize upon its prey. It happens sometimes, however, that the ant or the wood-louse is too nimble, and runs up the sides of the pit-fall before the other can make ready to seize it. The lion-ant has then another contrivance, still more wonderful than the former; for, by means of its broad head and feelers, it has a method of throwing up a shower of sand which falls upon the struggling captive with tremendous weight, and once more crushes it down to the bottom. When the insect is once fallen thus low, no efforts can retrieve or release it; the lion-ant seizes it with its feelers, which are hollow, and darting them both into its body, sucks out all the little animal's juices with the utmost rapacity.

When the prey is thus reduced to a husk, and nothing but the external form remains, the next care of the murderer is to remove the body from its cell; since the appearance of dead carcases might forewarn other insects of the danger of the place. The insect, therefore, takes up the wasted trunk with its feelers, and throws it with wonderful strength, at least six inches from the edge of its hole; and then patiently sets about mending the breaches which its fortifications had received in the last engagement. Nothing can abate its industry, its vigilance, its patience or its rapacity. It will work for a week together to make its pit-fall; it will continue upon the watch for more than a month, patiently expecting the approach of

its prey; and if it comes in greater quantities than is needful, yet still the little voracious creature will quit the insect it has newly killed, and leave it half eaten, to kill and attack any other that happens to fall within the sphere of its malignity: though so voracious, it is surprisingly patient of hunger; some of them having been kept in a box with sand for six months and upwards without feeding at all.

When the lion-ant attains a certain age, in which it is to change into another form, it then leaves off its usual rapacious habits, but keeps on its industry. It no longer continues to make pits, but furrows up the sand all round in an irregular manner; testifying those workings and violent agitations which most insects exhibit previous to their transformation. These animals are produced in autumn, and generally live a year, and perhaps two, before they assume a winged form. Certain it is, that they are found at the end of winter of all sizes; and it would seem that many of the smaller kinds had not yet attained sufficient maturity for transformation. Be this as it may, when the time of change approaches, if the insect finds its little cell convenient, it seeks no other: if it is obliged to remove, after furrowing up the sand, it hides itself under it, horns and all. It there spins a thread, in the manner of the spider; which being made of a glutinous substance, and being humid from the moisture of its body, sticks to the little particles of sand among which it is spun; and in proportion as it is thus excluded, the insect rolls up its web, sand and all, into a ball, of which itself is the center. This ball is about half an inch in diameter; and within it the insect resides, in an apartment sufficiently spacious for all its motions. The

outside is composed of sand and silk; the inside is lined with silk only, of a fine pearl colour, extremely delicate, and perfectly beautiful. But though the work is so curious within, it exhibits nothing to external appearance but a lump of sand; and thus escapes the search of birds, that might otherwise disturb the inhabitant within.

The insect continues thus shut up for six weeks or two months; and gradually parts with its eyes, its feelers, its feet, and its skin; all which are thrust into the corner of the inner apartment like a rag. The insect then appears almost in its winged state, except that there is a thin skin which wraps up the wings, and that appears to be nothing else but a liquor dried on their outside. Still, however, the little animal is too delicate and tender to venture from its retreat; but continues inclosed for ſome time longer; at length, when the members of this new insect have acquired the necessary consistence and vigour, it tears open its lodging, and breaks through its wall. For this purpose it has two teeth, like those of grasshoppers, with which it eats through, and enlarges the opening, till it gets out. Its body, which is turned like a screw, takes up no more than the space of a quarter of an inch; but when it is unfolded, it becomes half an inch in length; while its wings, that seemed to occupy the smallest space, in two minutes time unfold, and become longer than the body. In short, it becomes a large and beautiful fly of the libellula kind, with a long slender body, of a brown colour; a small head with large bright eyes, long slender legs, and four large transparent reticulated wings. The rest of its habits resemble that insect whose form it bears; except, that instead of dropping its

eggs in the water, it deposits them in sand, where they are soon hatched into that rapacious insect so justly admired for its method of catching its prey.

CHAP. IV.

Of the Grasshopper, the Locust, the Cicada, the Cricket, and the Mole Cricket.

BELONGING to the second order of insects, we find a tribe of little animals, which, though differing in size and colour, strongly resemble each other in figure, appetites, nature, and transformation. But though they all appear of one family, yet man has been taught to hold them in different estimation; for while some of this tribe amuse him with their chirpings, and banish solitude from the fields, others come in swarms, eat up every thing that is green, and in a single night convert the most delightful landscape into a dreary waste. However, if these animals be separately considered, the devouring locust is not in the least more mischievous than the musical grasshopper; the only difference is, that one species comes for food in a swarm, the other feeds singly.

That animal which is called the Grasshopper with us, differs greatly from the cicada of antiquity; for as our insect is active enough in hopping through the long grass, from whence it has taken its name, the cicada had not this power, but either walked or flew. The little hissing note also of our grasshopper is very different from the song of the cicada, which was louder and far more musical. The manner in which

this note is produced by the two animals is very different; for the cicada makes it by a kind of buckler, which the male has beneath its belly; the grasshopper by a transparent membrane that covers an hole at the base of its wings. There is still a greater variety in all these with regard to shape and colour. Some are green, some black, some livid, and some variegated: but many of them do not shew all their colours till they fly. Some have long legs, some short, some with more joints, others with fewer. Some sing, others are mute; some are innocent, doing no damage to the husbandman; while others do such prodigious mischief, that they are looked upon in some countries, as one of the terrible scourges of the incensed Divinity.

Of this variegated tribe, the little grasshopper that breeds in such plenty in every meadow, and that continues its chirping through the summer, is best known to us; and by having its history we shall be possessed of that of all the rest. This animal is of the colour of green leaves, except a line of brown which streaks the back, and two pale lines under the belly and behind the legs. It may be divided into the head, the corslet, and the belly. The head is oblong, regarding the earth, and bearing some resemblance to that of an horse. Its mouth is covered by a kind of round buckler jutting over it, and armed with teeth of a brown colour, hooked at the points. Within the mouth is perceivable a large reddish tongue, and fixed to the lower jaw. The feelers or horns are very long, tapering off to a point; and the eyes are like two black specks, a little prominent. The corslet is elevated, narrow, armed above and below by two serrated spines. The back is armed with a

strong buckler, to which the muscles of the legs are firmly bound, and round these muscles are seen the vessels by which the animal breathes, as white as snow. The last pair of legs are much longer and stronger than the first two pair, fortified by thick muscles, and very well formed for leaping. It has four wings; the anterior ones springing from the second pair of legs, the posterior from the third pair. The hinder wings are much finer and more expansive than the foremost, and are the principal instruments of its flight. The belly is considerably large, composed of eight rings, and terminated by a forky tail, covered with down, like the tail of a rat. When examined internally, besides the gullet, we discover a small stomach; and behind that a very large one, wrinkled and furrowed within side: lower down there is still a third; so that it is not without reason that all the animals of this order are said to chew the cud, as they so much resemble ruminant animals in their internal conformation.

A short time after the grasshopper assumes its wings, it fills the meadow with its note; which like that among birds, is a call to courtship. The male only of this tribe is vocal; and upon examining at the base of the wings, there will be found a little hole in its body, covered with a fine transparent membrane. This is thought, by Linnæus, to be the instrument it employs in singing; but others are of opinion the sound is produced by rubbing its hinder legs against each other: however this be, the note of one male is seldom heard, but it is returned by another: and the two little animals, after many mutual insults of this kind, are seen to meet and fight desperately. The female is generally the re-

ward of victory; for, after the combat, the male seizes her with his teeth behind the neck, and thus keeps her for several hours, till the business of fecundation is performed. They are at that time so strongly united, that they can scarcely be separated without tearing asunder. Towards the latter end of autumn the female prepares to deposite her burthen; and her body is then seen greatly distended with her eggs, which she carries to the number of an hundred and fifty. In order to make a proper lodgment in the earth for them, Nature has furnished her with an instrument at her tail, somewhat resembling a two-edged sword, which she can sheathe and unsheathe at pleasure; with this she pierces the earth as deep as she is able; and into the hole which her instrument has made she deposits her eggs, one after the other.

Having thus provided for the continuation of her posterity, the animal herself does not long survive; but, as the winter approaches, she dries up, seems to feel the effects of age, and dies from a total decay. Some, however, assert, that she is killed by the cold; and others, that she is eaten by worms: but certain it is, that neither the male nor female are ever seen to survive the winter. In the mean time the eggs which have been deposited continue unaltered, either by the severity of the season, or the retardation of the spring. They are of an oval figure, white, and of the consistence of horn: their size nearly equals that of a grain of anise: they are enveloped in the body within a covering, branched all over with veins and arteries; and when excluded, they crack, on being pressed between the fingers: their substance within is a whitish, viscous, and

transparent fluid. In this manner they remain deposited beneath the surface of the earth, during the whole winter; till the genial return of spring begins to vivify and hatch them. The sun, with its warmth, beginning to animate all nature, the insect eggs feel its benign influence; and generally, about the beginning of May, every egg produces an insect, about the size of a flea. These at first are of a whitish colour; at the end of two or three days they turn black; and soon after they become of a reddish brown. They appear, from the beginning, like grasshoppers wanting wings; and hop among the grass, as soon as excluded, with great agility.

Yet still they are by no means arrived at their state of full perfection; although they bear a strong resemblance to the animal in its perfect form. They want, or seem to want, the wings, which they are at last seen to assume; and can only hop among the grass without being able to fly. The wings, however, are not wanting, but are concealed within four little bunches, that seem to deform the ſides of the animal: there they lie rolled up in a most curious manner; and occupying a smaller space than one could conceive who saw them extended. Indeed, all insects, whatever transmutations they seem to undergo, are yet brought forth with those very limbs, parts and wings, which they afterwards seem to acquire. In the most helpless caterpillar, there is still to be seen the rudiments of that beautiful plumage which it afterwards expands when a butterfly; and though many new parts seem unfolded to the view, the animal acquires none but such as it was from the beginning possessed of. The grasshopper, therefore, though seemingly without wings,

is in reality, from the first, possessed of those instruments, and only waits for sufficient force to break the bonds that hold them folded up, and to give them their full expansion.

The grasshopper, that for above twenty days from its exclusion has continued without the use of its wings, which were folded up to its body, at length prepares for its emancipation, and for a life of greater liberty and pleasure. To make the proper dispositions for the approaching change, it ceases from its grassy food, and seeks about for a convenient place, beneath some thorn or thistle, that may protect it from an accidental shower. The same laborious writhings and workings, heavings and palpitations, which we have remarked in every other insect upon an approaching change, are exhibited in this. It swells up its head and neck; it then seems to draw them in again; and thus alternately, for some time, it exerts its powers to get free. At length, the skin covering the head and breast is seen dividing above the neck; the head is seen issuing out first from the bursting skin; the efforts still continuing, the other parts follow successively; so that the little animal, with its long feelers, legs and all, works its way from the old skin, that remains fixed to the thistle or the thorn. It is indeed inconceivable how the insect can thus extricate itself from so exact a sheath as that which covereth every part of its body.

The grasshopper, thus disengaged from its outer skin, appears in its perfect form; but then so feeble, and its body so soft and tender, that it may be moulded like wax. It is no longer of that obscure colour which it exhibited before, but a greenish

white, which becomes more vivid as the moisture on the surface is dried away. Still, however, the animal continues to shew no signs of life, but appears quite spent and fatigued with its labour for more than an hour together. During this time, the body is drying, and the wings unfolding to their greatest expansion; and the curious observer will perceive them, fold after fold, opening to the sun, till at last they become longer than the two hinder legs. The insect's body also is lengthened during this operation, and it becomes much more beautiful than before.

These insects are generally vocal in the midst of summer; and they are heard at sun-setting much louder than during the heats of the day. They are fed upon grass; and, if their belly be pressed, they will be seen to return the juices of the plants they have last fed upon. Though unwilling to fly, and slow in flight, particularly when the weather is moist or cool, they are sometimes seen to fly to considerable distances. If they are caught by one of the hinder legs, they quickly disengage themselves from it, and leave the leg behind them. This, however, does not grow again, as with crabs or spiders; for as they are animals but of a single year's continuance, they have not sufficient time for repairing those accidental misfortunes. The loss of their leg also prevents them from flying; for, being unable to lift themselves in the air, they have not room upon the ground for the proper expansion of their wings. If they be handled roughly, they will bite very fiercely; and when they fly, they make a noise with their wings. They generally keep in the plain, where the grass is luxuriant, and the ground rich and fertile: there they deposit their eggs, particu-

larly in those cracks which are formed by the heat of the sun.

Such are the habits and nature of those little vocal insects, that swarm in our meadows, and enliven the landscape. The larger kinds only differ from them in size, in rapidity of flight, and the powers of injuring mankind, by swarming upon the productions of the earth. The quantity of grass which a few grasshoppers that sport in the fields can destroy, is trifling; but when a swarm of locusts, two or three miles long, and several yards deep, settle upon a field, the consequences are frightful. The annals of every country are marked with the devastation which such a multitude of insects produces; and though they seldom visit Europe in such dangerous swarms as formerly, yet, in some of the southern kingdoms, they are still formidable. Those which have at uncertain intervals visited Europe, in our memory, are supposed to have come from Africa, and the animal is called the Great Brown Locust. It was seen in several parts of England in the year 1748, and many dreadful consequences were apprehended from its appearance. This insect is about three inches long, and has two horns or feelers, an inch in length. The head and horns are of a brownish colour: it is blue about the mouth, as also on the inside of the larger legs. The shield that covers the back is greenish; and the upper side of the body brown, spotted with black, and the under side purple. The upper wings are brown, with small dusky spots, with one larger at the tips; the under wings are more transparent, and of a light brown, tinctured with green, but there is a dark cloud of spots near the tips. This is that insect that has threatened us

so often with its visitations; and that is so truly terrible in the countries where it is bred. There is no animal in the creation that multiplies so fast as these, if the sun be warm, and the soil in which their eggs are deposited be dry. Happily for us, the coldness of our climate, and the humidity of our soil, are no way favourable to their production; and as they are but the animals of a year, they visit us and perish.

The Scripture, which was written in a country where the locust made a distinguished feature in the picture of Nature, has given us several very striking images of this animal's numbers and rapacity. It compares an army, where the numbers are almost infinite, to a swarm of locusts: it describes them as rising out of the earth, where they are produced; as pursuing a settled march to destroy the fruits of the earth, and co-operate with divine indignation.

When the locusts take the field, as we are assured, they have a leader at their head, whose flight they observe, and pay a strict attention to all his motions. They appear, at a distance, like a black cloud, which, as it approaches, gathers upon the horizon, and almost hides the light of the day. It often happens that the husbandman sees this imminent calamity pass away without doing him any mischief; and the whole swarm proceed onward, to settle upon the labours of some less fortunate country. But wretched is the district upon which they settle; they ravage the meadow and the pasture ground; strip the trees of their leaves, and the garden of its beauty: the visitation of a few minutes destroys the expectations of a year; and a famine but too frequently ensues. In their native tropical climates they are not so dreadful as in the more southern

parts of Europe. There, though the plain and the forest be stripped of their verdure, the power of vegetation is so great, that an interval of three or four days repairs the calamity: but our verdure is the livery of a season, and we must wait till the ensuing spring repairs the damage. Besides, in their long flights to this part of the world, they are famished by the tediousness of their journey, and are therefore more voracious wherever they happen to settle. But it is not by what they devour that they do so much damage as by what they destroy. Their very bite is thought to contaminate the plant, and to prevent its vegetation. To use the expression of the husbandman, they burn whatever they touch; and leave the marks of their devastation for two or three years ensuing. But if they be noxious while living, they are still more so when dead; for whereever they fall, they infect the air in such a manner, that the smell is insupportable. Orosius tells us, that in the year of the world 3800, there was an incredible number of locusts which infected Africa; and, after having eaten up every thing that was green, they flew off and were drowned in the African sea; where there caused such a stench, that the putrefying bodies of hundreds of thousands of men could not equal it.

In the year 1690, a cloud of locusts was seen to enter Russia in three different places; and from thence to spread themselves over Poland and Lithuania, in such astonishing multitudes, that the air was darkened, and the earth covered with their numbers. In some places they were seen lying dead, heaped upon each other four feet deep; in others, they covered the surface like a black cloth: the trees

bent beneath their weight; and the damage which the country sustained exceeded computation. In Barbary their numbers are formidable, and their visits are frequent. In the year 1724, Doctor Shaw was a witness in that country of their devastations. Their first appearance was about the latter end of March; when the wind had been southerly for some time: in the beginning of April, their numbers were so vastly increased, that in the heat of the day they formed themselves into large swarms, which appeared like clouds, and darkened the sun. In the middle of May they began to disappear, retiring into the plains to deposit their eggs. In the next month, being June, the young brood began to make their appearance, forming many compact bodies of several hundred yards square; which afterwards marching forward, climbed the trees, walls, and houses, eating every thing that was green in their way. The inhabitants, to stop their progress, laid trenches all over their fields and gardens, filling them with water. Some placed large quantities of heath, stubble, and such like combustible matter, in rows, and set them on fire on the approach of the locusts. But all this was to no purpose; for the trenches were quickly filled up, and the fires put out by the vast number of swarms that succeeded each other. A day or two after one of these was in motion; others, that were just hatched, came to glean after them, gnawing off the young branches and the very bark of the trees. Having lived near a month in this manner, they arrived at their full growth, and threw off their worm-like state, by casting their skins. To prepare themselves for this change, they fixed their hinder feet

to some bush or twig, or corner of a stone, when immediately, by an undulating motion used on this occasion, their heads would first appear, and soon after the rest of their bodies. The whole transformation was performed in seven or eight minutes time; after which, they were a little while in a languishing condition; but as soon as the sun and air had hardened their wings, and dried up the moisture that remained after casting off their sloughs, they returned again to their former greediness, with an addition both of strength and agility. But they did not continue long in this state before they were entirely dispersed; after laying their eggs, directing their course northward, and probably perished in the sea. It is said that the holes these animals make to deposit their eggs, are four feet deep in the ground; the eggs are about fourscore in number, of the fize of caraway comfits, and bundled up together in clusters.

It would be endless to recount all the mischiefs which these famished insects have at different times occasioned; but what can have induced them to take such distant flights, when they come into Europe, is not so easy to be accounted for. It seems most probable, that by means of a very dry season in the heart of Africa, they are propagated in such numbers, that the vegetables of the spot where they are produced are not sufficient to sustain them. Thus being obliged to find out other countries, they traverse the sandy deserts, where they can find no sustenance; still meeting with nothing to allure them from their height, they proceed forward across the sea, and thus come into Europe, where they alight upon the first green pastures that occur.

In some parts of the world, the inhabitants turn what seems a plague to their own advantage. Locusts are eaten by the natives in many kingdoms of the East; and are caught in small nets provided for that purpose. They parch them over the fire in an earthen pan; and when their wings and legs are fallen off, they turn reddish, of the colour of boiled shrimps. Dampier has eat them thus prepared, and thinks them a tolerable dish. The natives of Barbary also eat them fried with salt; and they are said to taste like cray-fish.

There is a locust in Tonquin, about the bigness of the top of a man's finger, and as long as the first joint. It breeds in the earth, in low grounds; and in the months of January and February, which is the season for taking them, they issue from the earth in vast swarms. At first they can hardly fly, so that they often fall into the rivers in great numbers: however, the natives in these months watch the rivers, and take them up in multitudes in small nets. They either eat them fresh, broiled on the coals, or pickle them for keeping. They are considered as a great delicacy in that part of the world, as well by the rich as the poor. In the countries where they are eaten, they are regularly brought to market, and sold as larks or quails in Europe. They must have been a common food with the Jews, as Moses, in the book of Leviticus, permits them to eat four different kinds of this animal, which he takes care to specify. This dish, however, has not yet made its way into the kitchens of the luxurious in Europe; and though we may admire the delicacies of the East, we are as yet happily deprived of the powers of imitation.

Of all animals, however, of this noxious tribe, the Great West-Indian Locust, individually considered, is the most formidable. It is about the thickness of the barrel of a goose-quill, and the body is divided into nine or ten joints, in the whole about six or seven inches long. It has two small eyes, standing out of the head like those of crabs, and two feelers like long hair. The whole body is studded with small excrescences, which are not much bigger than the points of pins. The shape is roundish, and the body diminishes in circumference to the tail, which is forked into two horns. Between these there is a sort of a sheath, containing a small dangerous sting. If any person happens to touch this insect he is sure to be stung; and is immediately taken with a shivering and trembling all over the body; which, however, may soon be put a stop to, by rubbing the place that was affected with a little palm-oil.*

From the locust we descend to the cricket, which is a very inoffensive and pretty animal. Though there be a species of this insect that lives entirely in the woods and fields, yet that with which we are best acquainted is the house-cricket, whose voice is so well known behind a country fire in a winter's evening. There is something so unusual in hearing a sound while we do not see the animal producing it, nor discover the place from whence it comes, that among the country people the chirping of the cricket is always held ominous; and whether it de-

[* What is the animal here mentioned, as having a dangerous sting, it is not easy to determine: it is certain that every insect of the locust tribe is perfectly harmless.]

serts the fire-side, or pays an unexpected visit, the credulous peasantry always find something to be afraid of. In general, however, the killing of a cricket is considered as a most unlucky omen; and though their company is not much desired, yet no methods must be taken to remove them.

The cricket very much resembles the grasshopper in its shape, its manner of ruminating, its voice, its leaping, and methods of propagation. It differs in its colour, which is uniformly of a rusty brown; in its food, which is more various; and in its place of residence, which is most usually in the warmest chinks behind a country hearth. They are, in some measure, obliged to the bad masonry employed in making peasants houses for their retreats. The smallest chink serves to give them shelter; and where they once make their abode they are sure to propagate. They are of a most chilly nature, seldom leaving the fire-side; and, if undisturbed, are seen to hop from their retreats to chirrup at the blaze in the chimney. The wood-cricket is the most timorous animal in nature; but the chimney-cricket, being used to noises, disregards not only those, but the appearance of people near it. Whether the voice of this animal is formed in the same manner with that of the grasshopper, by a fine membrane at the base of the wings, which is moved by a muscle, and which being coiled up, gives a sound like a quail-pipe, is not yet ascertained; nor do we well know the use of this voice, since anatomical inspection has not yet been able to discover the smallest organs of hearing. Still, however, we can make no doubt of their power of distinguishing sounds, though probably not in the same manner

with the more perfect ranks of nature. Certain it is that I have often heard them call, and this call was as regularly answered by another, although none but the males are vocal.

As the cricket lives chiefly in the dark, so its eyes seem formed for the gloominess of its abode; and those who would surprise it, have only to light a candle unexpectedly; by which it is dazzled, and cannot find the way back to its retreat. It is a very voracious little animal, and will eat bread, flower, and meat; but it is particularly fond of sugar. They never drink, but keep for months together at the back of the chimney, where they could possibly have had no moisture. The warmth of their situation only serves to increase their mirth and loquacity. Except in the very coldest weather, they never cease their chirruping, but continue that little piercing note, which is as pleasing to some as it is disagreeable to others. The great Scaliger was particularly delighted with the chirruping of crickets, and kept several of them for his amusement, enclosed in a box, which he placed in a warm situation. Others, on the contrary, think there is something ominous and melancholy in the sound, and use every endeavour to banish this insect from their houses. Ledelius tells us of a woman who was very much incommoded by crickets, and tried, but in vain, every method of banishing them from her house. She at last accidentally succeeded; for having one day invited several guests to her house, where there was a wedding, in order to increase the festivity of the entertainment she procured drums and trumpets to entertain them. The noise of these was so much greater than what the little

animals were used to, that they instantly forsook their situation, and were never heard in that mansion more.

But of all the cricket kind, that which is called the mole-cricket is the most extraordinary. This animal is the largest of all the insects with which we are acquainted in this country, being two inches and an half in length, and three quarters of an inch in breadth. The colour is of a dusky brown; and at the extremity of the tail there are two hairy excrescences, resembling in some sense the tail of a mouse. The body consists of eight scaly joints or separate folds, is brown on the upper part, and more deeply tinged below. The wings are long, narrow, and terminate in a sharp point, each having a blackish line running down it: however, when they are extended, they appear to be much broader than could at first sight be supposed. The shield of the breast is of a firm texture, of a blackish colour, and hairy. The fore-feet, which are this animal's principal instruments of burrowing into the earth, are strong, webbed, and hairy; it generally, however, runs backward; but it is commonly under ground, where it burrows even faster than a mole. It is thought also to be amphibious, and capable of living under water, as well as under ground.

Of all insects this is the most detested by gardeners, as it chiefly resides in that ground which lies light, and where it finds sufficient plenty under the surface. Thus, in a single night's time, it will run along a furrow which has been newly sown, and rob it of all its contents. Its legs are formed in such a manner that it can penetrate the earth in

every direction; before, behind, and above it. At night it ventures from its underground habitation, and, like the cricket, has its chirping call. When the female is fecundated, she makes a cell of clammy earth, the inside of which is large enough to hold two hazel nuts; and in this she lays her eggs. The whole nest is about the size of a common hen's egg, closed up on every side, and well defended from the smallest breath of air. The eggs generally amount to the number of an hundred and fifty, being white, and about the size of a carraway comfit. They are thus carefully covered, as well to defend them from the injuries of the weather, as from the attacks of the black beetle; that being itself an underground inhabitant, would, but for this precaution, devour or destroy them. To prevent this, the female mole cricket is often posted as a centinel near the nest, and when the black invader plunges in to seize its prey, the guardian insect seizes him behind, and instantly bites him in two.

Nothing can exceed the care and assiduity which these animals exhibit in the preservation of their young. Wherever the nest is placed, there seems to be a fortification, avenues and entrenchments, drawn round it: there are numberless winding ways that lead to it, and a ditch drawn about it, which few of its insect enemies are able to pass. But their care is not confined to this only; for at the approach of winter they carry their nest entirely away, and sink it deeper in the ground, so that the frost can have no influence in retarding the young brood from coming to maturity. As the weather grows milder, they raise their magazine in proportion; till, at last, they bring it as near the surface

as they can, to receive the genial influence of the sun, without wholly exposing it to view: yet, should the frost unexpectedly return, they sink it again as before.

[Among this tribe may be numbered the great lanthorn-fly of Peru; an insect, without doubt, the most splendid and luminous of all that are yet known. The head is extended forward, large, and hollow: the antennæ are seated below the eyes, and consist of only two joints: the beak is bent inwards under the body; and it is with this it extracts the juices from plants. In the head is contained a phosphorescent light, sufficiently vivid to serve the purposes of a candle in a dark room; or when two or three are put together at the end of a stick, to light travellers on the road like a lanthorn. No sight can be more splendid than the effects produced by these animals, when numbers of them are seen in an evening hovering about the trees. It is about the size of the larger kind of locust, and the wings and whole body are beautifully variegated.]

CHAP. V.

Of the Earwig, the Froth Insect, and some others belonging to the second Order of Insects.

WE should still keep in memory that all insects of the second order, though not produced quite perfect from the egg, yet want very little of their perfection, and require but a very small change to arrive at that state which fits them for flight and generation. The natural functions in these are

never suspended: from the instant they leave the egg, they continue to eat, to move, to leap, and pursue their prey: a slight change ensues; a skin that enclosed a part of their body and limbs, bursts behind, like a woman's stays, and gives freedom to a set of wings, with which the animal expatiates, and flies in pursuit of its mate.

Of all this class of insects, the Earwig undergoes the smallest change. This animal is so common that it scarcely needs a description: its swiftness in the reptile state is not less remarkable than its indefatigable velocity when upon the wing. That it must be very prolific, appears from its numbers; and that it is very harmless, every one's experience can readily testify. It is provided with six feet, and two feelers: the tail is forked; and with this it often attempts to defend itself against every assailant. But its attempts are only the threats of impotence; they draw down the resentment of powerful animals, but no way serve to defend it. The deformity of its figure, and its slender make, have also subjected it to an amputation, which, though entirely founded in prejudice, has more than once procured its destruction. It is supposed, as the name imports, that it often enters into the ears of people sleeping; thus causing madness, from the intolerable pain, and soon after death itself. Indeed, the French name, which signifies the ear-piercer, urges the calumny against this harmless insect, in very plain terms: yet nothing can be more unjust; the ear is already filled with a substance which prevents any insect from entering; and besides, it is well lined and defended with membranes, which would keep out any little

animal, even though the ear-wax were away. These reproaches, therefore, are entirely groundless: but it were well if the accusations which gardeners bring against the earwig were as slightly founded. There is nothing more certain than that it lives among flowers, and destroys them. When fruit also has been wounded by flies, the earwig generally comes in for a second feast, and sucks those juices which they first began to broach. Still, however, this insect is not so noxious as it would seem; and seldom is found but where the mischief has been originally begun by others. Like all of this class, the earwig is hatched from an egg. As there are various kinds of this animal, so they chuse different places to breed in: in general, however, they lay their eggs under the bark of plants, or in the clefts of trees, when beginning to decay. They proceed from the egg in that reptile state in which they are most commonly seen; and, as they grow larger, the wings bound under the skin begin to burgeon. It is amazing how very little room four large wings take up before they are protruded; for no person could ever conceive such an expansion of natural drapery could be rolled up in so small a pacquet. The sheath in which they are enveloped, folds and covers them so neatly, that the animal seems quite destitute of wings*; and even when they are burst from their confinement, the animal, by the power of the muscles and joints which it has in the middle of its wings, can closely fold them into a very narrow compass. When the earwig has become a winged insect, it flies in pursuit of the

* Swammerdam, p. 114.

female, ceasing to feed, and is wholly employed in the business of propagation. It lives, in its winged state, but a few days; and having taken care for the continuance of posterity, dries up, and dies, to all appearance consumptive.*

To this order of insects we may also refer the Cuckow Spit, or Froth Worm, that is often found hid in that frothy matter which we find on the surface of plants. It has an oblong, obtuse body; and a large head, with small eyes. The external wings, for it has four, are of a dusky brown colour, marked with two white spots: the head is black. The spume in which it is found wallowing, is all of its own formation, and very much resembles frothy spittle. It proceeds from the vent of the animal, and other parts of the body; and if it be wiped away, a new quantity will be quickly seen ejected from the little animal's body. Within this spume it is seen in time to acquire four tubercles on its back, wherein the wings are enclosed: these bursting, from a reptile it becomes a winged animal; and thus rendered perfect, it flies to meet its mate, and propagate its kind.

The Water Tipula also belongs to this class. It has an oblong slender body, with four feet fixed upon the breast, and four feelers near the mouth. It has four weak wings, which do not at all seem proper for flying, but leaping only. But what this insect chiefly demands our attention for is, the won-

[* The indefatigable M. de Geer has discovered that the female earwig sits over her eggs, and fosters her young, as a hen does her chicken. He observed, that when they were alarmed, they thrust themselves under the belly and between the legs of the mother, and remained there frequently for an hour together.]

derful lightness wherewith it runs on the surface of the water, so as scarcely to put it in motion. It is sometimes seen in rivers, and on their banks, especially under shady trees; and generally in swarms of several together.

The Common Water-fly also breeds in the same manner with those above mentioned. This animal is by some called the Notonecta, because it does not swim, in the usual manner, upon its belly, but on its back: nor can we help admiring that fitness in this insect for its situation, as it feeds on the under side of plants which grow on the surface of the water; and therefore it is thus formed with its mouth upwards, to take its food with greater convenience and ease.

We may also add the Water-Scorpion, which is a large insect, being near an inch in length, and about half an inch in breadth. Its body is nearly oval, but very flat and thin; and its tail long and pointed. The head is small; and the feelers appear like legs, resembling the claws of a scorpion, but without sharp points. This insect is generally found in ponds; and is, of all others, the most tyrannical and rapacious. It destroys, like a wolf among sheep, twenty times as many as its hunger requires. One of these, when put into a bason of water, in which were thirty or forty worms of the libellula kind, each as large as itself, destroyed them all in a few minutes, getting on their backs, and piercing with its trunk through their body. These animals, however, though so formidable to others, are nevertheless themselves greatly over-run with a little kind of louse, about the size of a nit, which very probably

repays the injury which the water-scorpion inflicts upon others.

The water-scorpions live in the water by day; out of which they rise in the dusk of the evening into the air, and so flying from place to place, often betake themselves, in quest of food, to other waters. The insect, before its wings are grown, remains in the place where it was produced; but when come to its state of perfection, sallies forth in search of a companion of the other sex, in order to continue its noxious posterity.

CHAP. VI.

Of the Ephemera.

THE last insect we shall add to this second order, is the Ephemera; which, though not strictly belonging to it, yet seems more properly referred to this rank than any other. Indeed, we must not attend to the rigour of method, in an history where Nature seems to take delight to sport in variety.

That there should be a tribe of flies whose duration extends but to a day, seems at first surprising; but the wonder will increase, when we are told, that some of this kind seem to be born and to die in the space of a single hour. The reptile, however, from which they are bred, is by no means so short-lived; but is sometimes seen to live two years, and many times three years together.

All ephemeras, of which there are various kinds, are produced from the egg, in the form of worms; from whence they change into a more perfect form;

namely, that of aurelias, which is a kind of middle state between a worm and a fly: and from thence they take their last mutation, which is into a beautiful fly, of longer or shorter duration, according to its kind.

The ephemera, in its fly state, is a very beautiful winged insect, and has a strong similitude to the butterfly, both from its shape and its wings. It is about the size of a middling butterfly; but its wings differ, in not being covered with the painted dust with which those of butterflies are adorned, and rendered opake, for they are very transparent and very thin. These insects have four wings, the uppermost of which are much the largest: when the insect is at rest, it generally lays its wings one over the other, on the back. The body is long, being formed of six rings, that are larger at the origin than near the extremity; and from this a tail proceeds, that is longer than all the rest of the fly, and consists sometimes of three threads of an equal length, or sometimes of two long and one short. To acquire this beautiful form, the insect has been obliged to undergo several transmutations: but its glory is very short-lived, for the hour of its perfection is the hour of its death; and it seems scarcely introduced to pleasure, when it is obliged to part with life.

The reptile that is to become a fly, and that is granted so long a term, when compared to its latter duration, is an inhabitant of the water, and bears a very strong resemblance to fishes, in many particulars; having gills by which it breathes at the bottom, and also the tapering form of aquatic animals. These insects have six scaly legs, fixed on their

corselet. Their head is triangular: the eyes are placed forward, and may be distinguished by their largeness and colour. The mouth is furnished with teeth; and the body consists of six rings; that next the corselet being largest, but growing less and less to the end: the last ring is the shortest, from which the three threads proceed, which are as long as the whole body. Thus we see that the reptile bears a very strong resemblance to the fly; and only requires wings, to be very near its perfection.

As there are several kinds of this animal, their aurelias are consequently of different colours; some yellow, some brown, and some cream-coloured. Some of these also bore themselves cells at the bottom of the water, from which they never stir out, but feed upon the mud composing the walls of their habitation, in contented captivity; others, on the contrary, range about, go from the bottom to the surface, swim between two waters, quit that element entirely to feed upon plants by the river side, and then return to their favourite element, for safety and protection.

The reptile, however, though it lives two or three years, offers but little, in its long duration, to excite curiosity: it is hid at the bottom of the water, and feeds almost wholly within its narrow habitation. The most striking facts command our attention during the short interval of its fly state; into which it crouds the most various transactions of its little life. It then may be said to be in a hurry to live, as it has but so small a time to exist. The peculiar sign whereby to know that these reptiles will change into flies in a short time, consists in a protuberance of the wings on the back. About that time

the smooth and depressed form of the upper part of the body, is changed into a more swolen and rounder shape; so that the wings are in some degree visible through the external sheath that covers them. As they are not natives of England, he who would see them in their greatest abundance, must walk, about sun-set, along the banks of the Rhine, or the Seine, near Paris; where, for about three days, in the midst of the summer, he will be astonished at their numbers and assiduity. The thickest descent of the flakes of snow in winter seems not to equal their number; the whole air seems alive with the new-born race, and the earth itself is all over covered with their remains. The aurelias, or reptile insects, that are as yet beneath the surface of the water, wait only for the approach of evening to begin their transformation. The most industrious shake off their old garments about eight o'clock; and those who are the most tardy, are transformed before nine*.

We have already seen that the operation of change in other insects is laborious and painful; but with these nothing seems shorter, or performed with greater ease. The aurelias are scarcely lifted above the surface of the water, than their old sheathing skin bursts; and through the cavity which is thus

[* Many of this tribe are natives of Britain, and may be seen rising out of streams and stagnant waters in vast numbers, during the autumn, soon after sunset. In their perfect state, the whole intention of nature appears to extend no farther than the propagation of their kind; and as in this state they do not feed, the mouth has no jaws. The female deposits her eggs in the water, in little clusters, quivering over the surface in an almost erect position. A single insect will lay six or seven hundred eggs.]

formed, a fly issues, whose wings, at the same instant, are unfolded, and at the same time lift it into the air. Millions and millions of aurelias, rise in this manner to the surface; and at once become flies, and fill every quarter with their flutterings. But all these sports are shortly to have an end; for as the little strangers live but an hour or two, the whole swarm soon falls to the ground, and covers the earth, like a deep snow, for several hundred yards, on every side of the river. Their numbers are then incredible, and every object they touch becomes fatal to them; for they instantly die, if they hit against even each other.

At this time the males and females are very differently employed. The males, quite inactive and apparently without desires, seem only born to die: no way like the males of other insects, they neither follow the opposite sex, nor bear any enmity to each other; after fluttering for an hour or two, they drop upon land, without seeming to receive wings for scarcely any other purpose but to satisfy an idle curiosity. It is otherwise with the females; that are scarcely risen from the surface of the water, and have dried their wings, but they hasten to drop their eggs back again. If they happen also to flutter upon land, they deposit their burthen in the place where they drop. But then it may be demanded, where and in what manner are these eggs fecundated, as no copulation whatever appears between the sexes, in their transitory visits in air? Swammerdam is of opinion, that they are impregnated in the manner of fish-spawn, by the male, after being ejected by the female: but, beside that this doctrine is exploded even from the history of fishes, it

is certain, that the males have not time for this operation, as the eggs drop to the bottom the instant they are laidon the water. Reaumur is of opinion that they copulate; but that the act bears a proportion in shortness to the small duration of their lives; and consequently must be so soon performed, as to be scarcely visible. This, however, is at best forcing a theory; and, it is probable, that as there are many insects known to breed without any impregnation from the male, as we have already seen in muscles and the oysters, and shall hereafter see in the gnat, and a species of the beetle, so the ephemera may be of this number. Be this as it may, the females are in such haste to deposit their eggs, that multitudes of them fall to the ground; but the greatest part are laid in the water. As they flutter upon the surface, two clusters are seen issuing from the extremity of their body, each containing about three hundred and fifty eggs, which make seven hundred in all. Thus, of all insects, this appears to be the most prolific; and it would seem that there was a necessity for such a supply, as, in its reptile state, it is the favourite food of every kind of fresh-water fish. It is in vain that these little animals form galleries at the bottom of the river, from whence they seldom remove; many kinds of fish break in upon their retreats, and thin their numbers. For this reason fishermen are careful to provide themselves with these insects, as the most grateful bait; and thus turn the fish's rapacity to its own destruction.

But though the usual date of those flies is two or three hours at farthest, there are some kinds that live several days; and one kind in particular, after quitting the water, has another case or skin to get

rid of. These are often seen in the fields and woods, distant from the water; but they are more frequently found in its vicinity. They are often found sticking upon walls and trees; and frequently with the head downwards, without changing place, or having any sensible motion. They are then waiting for the moment when they shall be divested of their last incommodious garment, which sometimes does not happen for two or three days together.

A

HISTORY

OF

INSECTS.

PART III.

CHAP. I.

Of Caterpillars in General.

IF we take a cursory view of insects in general, Caterpillars alone, and the butterflies and moths they give birth to, will make a third part of the number. Wherever we move, wherever we turn, these insects, in one shape or another, present themselves to our view. Some, in every state, offer the most entertaining spectacle; others are beautiful only in their winged form. Many persons, of which number I am one, have an invincible aversion to caterpillars, and worms of every species: there is something disagreeable in their slow crawling motion, for which the variety of their colouring can never compensate. But others feel no repugnance at observing, and even handling them with the most attentive application.

There is nothing in the butterfly state, so beautiful or splendid as these insects. They serve, not less than the birds themselves, to banish solitude from our walks, and to fill up our idle intervals with the most pleasing speculations. The butterfly makes one of the principal ornaments of oriental poetry; but, in those countries, the insect is larger and more beautiful than with us.

The beauties of the fly may therefore very well excite our curiosity to examine the reptile. But we are still more strongly attached to this tribe, from the usefulness of one of the number. The silkworm is, perhaps, the most serviceable of all other animals; since, from its labours, and the manu-

facture attending it, near a third part of the world are clothed, adorned, and supported.

Caterpillars may be easily distinguished from worms or maggots, by the number of their feet; and by their producing butterflies or moths. When the sun calls up vegetation, and vivifies the various eggs of insects, the caterpillars are the first that are seen, upon almost every vegetable and tree, eating its leaves, and preparing for a state of greater perfection. They have feet both before and behind; which not only enable them to move forward by a sort of steps made by their fore and hinder parts, but also to climb up vegetables, and to stretch themselves out from the boughs and stalks, to reach their food at a distance. All of this class have from eight feet, at the least, to sixteen; and this may serve to distinguish them from the worm tribe, that never have so many. The animal into which they are converted, is always a butterfly or a moth; and these are always distinguished from other flies, by having their wings covered over with a painted dust, which gives them such various beauty. The wings of flies are transparent, as we see in the common flesh-fly; while those of beetles are hard, like horn; from such the wing of a butterfly may be easily distinguished; and words would obscure their differences.

From hence it appears, that caterpillars, whether in the reptile state, or advanced to their last state of perfection into butterflies, may easily be distinguished from all other insects; being animals peculiarly formed, and also of a peculiar nature. The transmutations they undergo are also more numerous than those of any insect hitherto mentioned; and,

in consequence, they have been placed in the third order of changes by Swammerdam, who has thrown such lights upon this part of natural history. In the second order of changes, mentioned before, we saw the grasshopper and the earwig, when excluded from the egg, assume a form very like that which they were after to preserve; and seemed arrived at a state of perfection, in all respects, except in not having wings; which did not bud forth until they were come to maturity. But the insects of this third order, that we are now about to describe, go through a much greater variety of transformations: for, when they are excluded from the egg, they assume the form of a small caterpillar, which feeds and grows larger every day, often changing its skin, but still preserving its form. When the animal has come to a certain magnitude in this state, it discontinues eating, makes itself a covering or husk, in which it remains wrapped up, seemingly without life or motion; and after having for some time continued in this state, it once more bursts its confinement, and comes forth a beautiful butterfly. Thus we see this animal put on no less than three different appearances, from the time it is first excluded from the egg. It appears a crawling caterpillar; then an insensible aurelia, as it is called, without life or motion; and lastly, a butterfly, variously painted, according to its different kind. Having thus distinguished this class of insects from all others, we will first survey their history in general; and then enter particularly into the manners and nature of a few of them, which most deserve our curiosity and attention.

CHAP. II.

Of the Transformation of the Caterpillar into its corresponding Butterfly or Moth.

WHEN winter has disrobed the trees of their leaves, nature then seems to have lost her insects. There are thousands of different kinds, with and without wings; which, though swarming at other seasons, then entirely disappear. Our fields are re-peopled, when the leaves begin to bud, by the genial influence of spring; and Caterpillars, of various sorts, are seen feeding upon the promise of the year, even before the leaves are completely unfolded. Those caterpillars, which we then see, may serve to give us a view of the general means which nature employs to preserve such a number of insects during that season, when they can no longer find subsistence. It is known, by united experience, that all these animals are hatched from the eggs of butterflies; and those who observe them more closely, will find the fly very careful in depositing its eggs in those places where they are likely to be hatched with the greatest safety and success. During winter, therefore, the greatest number of caterpillars are in an egg state; and in this lifeless situation, brave all the rigours and the humidity of the climate: and though often exposed to all its changes, still preserve the latent principles of life, which is more fully exerted at the approach of spring. That same power that pushes forth the budding leaf, and the opening flower, impels the insect into animation: and Nature at once seems to furnish the

guest and the banquet. When the insect has found force to break its shell, it always finds its favourite aliment provided in abundance before it.

But all caterpillars are not sent off from the egg in the beginning of spring; for many of them have subsisted during the winter in their aurelia state: in which, as we have briefly observed above, the animal is seemingly deprived of life and motion. In this state of insensibility, many of these insects continue during the rigours of winter; some enclosed in a kind of shell, which they have spun for themselves at the end of autumn; some concealed under the bark of trees; others in the chinks of old walls; and many buried under ground. From all these, a variety of butterflies are seen to issue, in the beginning of spring; and adorn the earliest part of the year with their painted flutterings.

Some caterpillars do not make any change whatsoever at the approach of winter; but continue to live in their reptile state, through all the severity of the season. They chuse themselves some retreat, where they may remain undisturbed for some months together; and there they remain, quite motionless, and as insensible as if they were actually dead. Their constitution is such, that food, at that time, would be useless: and the cold prevents their making those dissipations which require restoration. In general, caterpillars of this kind are found in great numbers together, enclosed in one common web, that covers them all, and serves to protect them from the injuries of the air.

Lastly, there are some of the caterpillar kind, whose butterflies live all the winter; and who, having fluttered about for some part of the latter end of

autumn, seek for some retreat during the winter, in order to answer the ends of propagation, at the approach of spring. These are often found lifeless and motionless in the hollow of trees, or the clefts of timber; but, by being approached to the fire, they recover life and activity, and seem to anticipate the desires of the spring.

In general, however, whether the animal has subsisted in an egg state, during the winter; or whether as a butterfly, bred from an aurelia, in the beginning of spring; or a butterfly that has subsisted during the winter, and lays eggs as soon as the leaves of plants are shot forward, the whole swarm of caterpillars are in motion to share the banquet that Nature has provided. There is scarcely a plant that has not its own peculiar insects; and some are known to support several of different kinds. Of these, many are hatched from the egg, at the foot of the tree, and climb up to its leaves for subsistence: the eggs of others have been glued by the parent butterfly to the leaves; and they are no sooner excluded from the shell, but they find themselves in the midst of plenty.

When the caterpillar first bursts from the egg, it is small and feeble; its appetites are in proportion to its size, and it seems to make no great consumption: but as it increases in magnitude, it improves in its appetites; so that, in its adult caterpillar state, it is the most ravenous of all animals whatsoever. A single caterpillar will eat double its own weight of leaves in a day, and yet seems no way disordered by the meal.—What would mankind do, if their oxen or their horses were so voracious?

These voracious habits, with its slow crawling motion, but still more a stinging like that of nettles, which follows upon handling the greatest number of them, make these insects not the most agreeable objects of human curiosity. However, there are many philosophers who have spent years in their contemplation; and who have not only attended to their habits and labours, but minutely examined their structure and internal conformation.

The body of the caterpillar, when anatomically considered, is found composed of rings, whose circumference is pretty near circular or oval. They are generally twelve in number, and are all membranaceous; by which caterpillars may be distinguished from many other insects, that nearly resemble them in form. The head of the caterpillar is connected to the first ring by the neck; that is generally so short and contracted, that it is scarcely visible. All the covering of the head in caterpillars seems to consist of a shell; and they have neither upper nor under jaw, for they are both placed rather vertically, and each jaw armed with a large thick tooth, which is singly equal to numbers. With these the animals devour their food in such amazing quantities; and with these, some of the kind defend themselves against their enemies. Though the mouth be kept shut, the teeth are always uncovered; and while the insect is in health, they are seldom without employment. Whatever the caterpillar devours, these teeth serve to chop it into small pieces, and render the parts of the leaf fit for swallowing. Many kinds, while they are yet young, eat only the succulent part of the leaf, and leave all the fibres untouched; others, however, attack the

whole leaf, and eat it clean away. One may be amused, for a little time, in observing the avidity with which they are seen to feed; some are seen eating the whole day; others have their hours of repast; some chuse the night, and others the day. When the caterpillar attacks a leaf, it places its body in such a manner that the edge of the leaf shall fall between its feet, which keeps it steady, while the teeth are employed in cutting it: these fall upon the leaf, somewhat in the manner of a pair of gardener's shears; and every morsel is swallowed as soon as cut. Some caterpillars feed upon leaves so very narrow, that they are not broader than their mouths; in this case the animal is seen to devour it from the point, as we would eat a radish.

As there are various kinds of caterpillars, the number of their feet are various; some having eight, and some sixteen. Of these feet the six foremost are covered with a sort of shining gristle; and are therefore called the shelly legs. The hindmost feet, whatever be their number, are soft and flexible, and are called membranaceous. Caterpillars also, with regard to their external figure, are either smooth, or hairy. The skin of the first kind is soft to the touch, or hard, like shagreen; the skin of the latter is hairy, and as it were thorny; and generally, if handled, stings like nettles. Some of them even cause this stinging pain, if but approached too nearly.

Caterpillars, in general, have six small black spots placed on the circumference of the fore ring, and a little to the side of the head. Three of these are larger than the rest, and are convex and transparent: these Reaumur takes to be the eyes of the

caterpillar; however, most of these reptiles have very little occasion for sight, and seem only to be directed by their feeling.

But the parts of the caterpillar's body which most justly demand our attention, are the stigmata, as they are called; or those holes on the sides of its body, through which the animal is supposed to breathe. All along this insect's body, on each side, these holes are easily discoverable. They are eighteen in number, nine on a side, rather nearer the belly than the back; a hole for every ring, of which the animal's body is composed, except the second, the third, and the last. These oval openings may be considered as so many mouths, through which the insect breathes; but with this difference, that as we have but one pair of lungs, the caterpillar has no less than eighteen. It requires no great anatomical dexterity to discover these lungs in the larger kind of caterpillars: they appear, at first view, to be hollow cartilaginous tribes, and of the colour of mother-of-pearl. These tubes are often seen to unite with each other; some are perceived to open into the intestines; and some go to different parts of the surface of the body. That these vessels serve to convey the air, appears evidently, from the famous experiment of Malpighi; who, by stopping up the mouths of the stigmata with oil, quickly suffocated the animal, which was seen to die convulsed the instant after. In order to ascertain his theory, he rubbed oil upon other parts of the insect's body, leaving the stigmata free; and this seemed to have no effect upon the animal's health, but it continued to move and eat as usual: he rubbed oil on the stigmata of one side, and the animal underwent a

partial convulsion, but recovered soon after. However, it ought to be observed, that air is not so necessary to these as to the nobler ranks of animals, ſince caterpillars will live in an exhausted receiver for several days together; and though they seem dead at the bottom, yet, when taken out, recover, and resume their former vivacity.

If the caterpillar be cut open longitudinally along the back, its intestines will be perceived running directly in a straight line from the mouth to the anus. They resemble a number of small bags opening into each other; and strengthened on both sides by a fleshy cord, by which they are united. These insects are, upon many occasions, seen to cast forth the internal coat of their intestines with their food, in the changes, which they so frequently undergo. But the intestines take up but a small part of the animal's body, if compared to the fatty substance in which they are involved. This substance changes its colour when the insect's metamorphosis begins to approach; and from white it is usually seen to become yellow. If to these parts, we add the caterpillar's implements for spinning, (for all caterpillars spin at one time or another), we shall have a rude sketch of this animal's conformation: however, we shall reserve the description of those parts, till we come to the history of the silk-worm, where the manner in which these insects spin their webs, will most properly find a place.

The life of a caterpillar seems one continued succession of changes; and it is seen to throw off one skin only to assume another; which also is divested in its turn: and thus for eight or ten times successively. We must not, however, confound this

changing of the skin with the great metamorphosis which it is afterwards to undergo. The throwing off one skin, and assuming another, seems, in comparison, but a slight operation among these animals; this is but the work of a day; the other is the great adventure of their lives. Indeed, this faculty of changing the skin is not peculiar to caterpillars only, but is common to all the insect kind; and even to some animals that claim a higher rank in nature. We have already seen the lobster and the crab outgrowing their first shells, and then bursting from their confinement, in order to assume a covering more roomy and convenient. It is probable that the louse, the flea, and the spider, change their covering from the same necessity; and growing too large for the crust in which they have been for some time enclosed, burst it for another. This period is probably that of their growth; for as soon as their new skin is hardened round them, the animal's growth is necessarily circumscribed, while it remains within it. With respect to caterpillars, many of them change their skins five or six times in a season; and this covering, when cast off, often seems so complete, that many might mistake the empty skin for the real insect. Among the hairy caterpillars, for instance, the cast skin is covered with hair; the feet, as well gristly as membraneous, remain fixed to it; even the parts which nothing but a microscope can discover, are visible in it; in short, all the parts of the head; not only the skull, but the teeth.

In proportion as the time approaches in which the caterpillar is to cast its old skin, its colours become more feeble, the skin seems to wither and

grow dry, and in some measure resembles a leaf, when it is no longer supplied with moisture from the stock. At that time, the insect begins to find itself under a necessity of changing; and it is not effected without violent labour, and perhaps pain. A day or two before the critical hour approaches, the insect ceases to eat, loses its usual activity, and seems to rest immoveable. It seeks some place to remain in security; and no longer timorous, seems regardless even of the touch. It is now and then seen to bend itself and elevate its back; again it stretches to its utmost extent: it sometimes lifts up the head, and then lets it fall again; it sometimes waves it three or four times from side to side, and then remains in quiet. At length, some of the rings of its body, particularly the first and second, are seen to swell considerably, the old skin distends and bursts, till, by repeated swellings and contractions in every ring, the animal disengages itself, and creeps from its inconvenient covering.

How laborious soever this operation may be, it is performed in the space of a minute; and the animal, having thrown off its old skin, seems to enjoy new vigour, as well as acquired colouring and beauty. Sometimes it happens that it takes a new appearance, and colours very different from the old. Those that are hairy, still preserve their covering; although their ancient skin seems not to have lost a single hair: every hair appears to have been drawn, like a sword from the scabbard. However, the fact is, that a new crop of hair grows between the old skin and the new, and probably helps to throw off the external covering.

The caterpillar having in this manner continued for several days feeding, and at intervals casting its skin, begins at last to prepare for its change into an aurelia. It is most probable that, from the beginning, all the parts of the butterfly lay hid in this insect, in its reptile state; but it required time to bring them to perfection; and a large quantity of food, to enable the animal to undergo all the changes requisite for throwing off these skins, which seemed to clog the butterfly form. However, when the caterpillar has fed sufficiently, and the parts of the future butterfly have formed themselves beneath its skin, it is then time for it to make its first great and principal change into an aurelia, or a chrysalis, as some have chosen to call it; during which, as was observed, it seems to remain for several days, or even months, without life or motion.

Preparatory to this important change, the caterpillar most usually quits the plant, or the tree on which it fed; or at least attaches itself to the stalk or the stem, more gladly than the leaves. It forsakes its food, and prepares, by fasting, to undergo its transmutation. In this period, all the food it has taken is thoroughly digested; and it often voids even the internal membrane which lined its intestines. Some of this tribe, at this period also, are seen entirely to change colour; and the vivacity of the tints in all seem faded. Those of them which are capable of spinning themselves a web, set about this operation; those which have already spun, await the change in the best manner they are able. The web or cone, with which some cover themselves, hides the aurelia contained within from the view; but in others, where it is more transparent, the ca-

terpillar, when it has done spinning, strikes into it the claws of the two feet under the tail, and afterwards forces in the tail itself, by contracting those claws, and violently striking the feet one against the other. If, however, they be taken from their web at this time, they appear in a state of great languor; and, incapable of walking, remain on that spot where they are placed. In this condition they remain one or two days, preparing to change into an aurelia; somewhat in the manner they made preparations for changing their skin. They then appear with their bodies bent into a bow, which they now and then are seen to straiten: they make no use of their legs; but if they attempt to change place, do it by the contortions of their body. In proportion as their change into an aurelia approaches, their body becomes more and more bent: while their extensions and convulsive contractions become more frequent. The hinder end of the body is the part which the animal first disengages from its caterpillar skin; that part of the skin remains empty, while the body is drawn up contractedly towards the head. In the same manner they disengage themselves from the two succeeding rings; so that the animal is then lodged entirely in the fore part of its caterpillar covering: that half which is abandoned, remains flaccid and empty; while the fore part, on the contrary, is swolen and distended. The animal, having thus quitted the hinder part of its skin to drive itself up into the fore part, still continues to heave and work as before; so that the skull is soon seen to burst into three pieces, and a longitudinal opening is made in the three first rings of the body, through which the insect thrusts forth its naked bo-

dy, with strong efforts. Thus at last, it entirely gets free from its caterpillar skin, and for ever forsakes its most odious reptile form.

The caterpillar, thus stripped of its skin for the last time, is now become an aurelia; in which the parts of the future butterfly are all visible; but in so soft a state, that the smallest touch can discompose them. The animal is now become helpless and motionless; but only waits for the assistance of the air to dry up the moisture on its surface, and supply it with a crust capable of resisting external injuries. Immediately after being stripped of its caterpillar skin, it is of a green colour, especially in those parts which are distended by an extraordinary afflux of animal moisture; but in ten or twelve hours after being thus exposed, its parts harden, the air forms its external covering into a firm crust, and in about four-and-twenty hours, the aurelia may be handled without endangering the little animal that is thus left in so defenceless a situation. Such is the history of the little pod or cone that is found so common by every path-way, sticking to nettles, and sometimes shining like polished gold. From the beautiful and resplendent colour, with which it is thus sometimes adorned, some authors have called it a Chrysalis, implying a creature made of gold.

Such are the efforts by which these little animals prepare for a state of perfection; but their care is still greater to provide themselves a secure retreat, during this season of their imbecility. It would seem like erecting themselves a monument, where they were to rest secure, until Nature had called them into a new and more improved existence. For this purpose, some spin themselves a cone or web,

in which they lie secure till they have arrived at maturity: others, that cannot spin so copious a covering, suspend themselves by the tail, in some retreat where they are not likely to meet disturbances. Some mix sand with their gummy and moist webs, and thus make themselves a secure incrustation; while others, before their change, bury themselves in the ground, and thus avoid the numerous dangers that might attend them. One would imagine that they were conscious of the precise time of their continuance in their aurelia state; since their little sepulchres, with respect to the solidity of the building, are proportioned to such duration. Those that are to lie in that state of existence but a few days, make choice of some tender leaf, which they render still more pliant by diffusing a kind of glue upon it; the leaf thus gradually curls up, and withering as it enfolds, the insect wraps itself within, as in a mantle, till the genial warmth of the sun enables it to struggle for new life, and burst from its confinement. Others, whose time of transformation is also near at hand, fasten their tails to a tree, or to the first worm-hole they meet, in a beam, and wait in that defenceless situation. Such caterpillars, on the other hand, as are seen to lie several months in their aurelia state, act with much greater circumspection. Most of them mix their web with sand, and thus make themselves a strong covering: others build in wood, which serves them in the nature of a coffin. Such as have made the leaves of willows their favourite food, break the tender twigs of them first into small pieces, then pound them as it were to powder; and, by means of their glutinous silk, make a kind of paste, in which they wrap themselves up. Many are the forms which these ani-

mals assume in this helpless state; and it often happens, that the most deformed butterflies issue from the most beautiful aurelias.

In general, however, the aurelia takes the rude outline of the parts of the animal which is contained within it; but as to the various colours which it is seen to assume, they are rather the effect of accident; for the same species of insect does not at all times assume the same hue, when it becomes an aurelia. In some, the beautiful gold colour is at one time found; in others, it is wanting. This brilliant hue, which does not fall short of the best gilding, is formed in the same manner in which we see leather obtain a gold colour, though none of that metal ever enters into the tincture. It is only formed by a beautiful brown varnish, laid upon a white ground; and the white thus gleaming through the transparency of the brown, gives a charming golden yellow. These two colours are found, one over the other, in the aurelia of the little animal we are describing; and the whole appears gilded, without any real gilding.

The aurelia thus formed, and left to time to expand into a butterfly, in some measure resembles an animal in an egg, that is to wait for external warmth to hatch it into life and vigour. As the quantity of moisture that is enclosed within the covering of the aurelia, continues to keep its body in the most tender state, so it is requisite that this humidity should be dried away, before the little butterfly can burst its prison. Many have been the experiments to prove that nature may in this respect be assisted by art; and that the life of the insect may be retarded, or quickened, without doing it the smallest injury. For this purpose, it is only

requisite to continue the insect in its aurelia state, by preventing the evaporation of its humidity; which will consequently add some days, nay weeks, to its life: on the other hand, by evaporating its moisture, in a warm situation, the animal assumes its winged state before its usual time, and goes through the offices assigned its existence. To prove this, Mr. Reaumur enclosed the aurelia in a glass tube; and found the evaporated water, which exhaled from the body of the insect, collected in drops at the bottom of the tube: he covered the aurelia with varnish; and this making the evaporation more difficult and slow, the butterfly was two months longer than its natural term, in coming out of its case: he found, on the other hand, that by laying the animal in a warm room, he hastened the disclosure of the butterfly; and by keeping it in an ice-house in the same manner, he delayed it. Warmth acted, in this case, in a double capacity; invigorating the animal, and evaporating the moisture.

The aurelia, though it bears a different external appearance, nevertheless contains within it all the parts of the butterfly in perfect formation; and laying each in a very orderly manner, though in the smallest compass. These, however, are so fast and tender, that it is impossible to visit without discomposing them. When either by warmth, or increasing vigour, the parts have acquired the necessary force and solidity, the butterfly then seeks to disembarrass itself of those bands which kept it so long in confinement. Some insects continue under the form of an aurelia not above ten days; some twenty: some several months; and even for a year together.

The butterfly, however, does not continue so long under the form of an aurelia, as one would be apt to imagine. In general, those caterpillars that provide themselves with cones, continue within them but a few days after the cone is completely finished. Some, however, remain buried in this artificial covering for eight or nine months, without taking the smallest sustenance during the whole time: and though in the caterpillar state no animals were so voracious, when thus transformed, they appear a miracle of abstinence. In all, sooner or later, the butterfly bursts from its prison; not only that natural prison which is formed by the skin of the aurelia, but also from that artificial one of silk, or any other substance in which it has enclosed itself.

The efforts which the butterfly makes to get free from its aurelia state, are by no means so violent as those which the insect had in changing from the caterpillar into the aurelia. The quantity of moisture surrounding the butterfly is by no means so great as that attending its former change; and the shell of the aurelia is so dry, that it may be cracked between the fingers.

If the animal be shut up within a cone, the butterfly always gets rid of the natural internal skin of the aurelia, before it eats its way through the external covering which its own industry has formed round it. In order to observe the manner in which it thus gets rid of the aurelia covering, we must cut open the cone, and then we shall have an opportunity of discovering the insect's efforts to emancipate itself from its natural shell. When this operation begins, there seems to be a violent agitation in the humours contained within the little animal's body.

Its fluids seem driven, by an hasty fermentation, through all the vessels; while it labours violently with its legs, and makes several other violent struggles to get free. As all these motions concur with the growth of the insect's wings and body, it is impossible that the brittle skin which covers it should longer resist: it at length gives way, by bursting into four distinct and regular pieces. The skin of the head and legs first separates; then the skin at the back flies open, and dividing into two regular portions, disengages the back and wings: then there likewise happens another rupture in that portion which covered the rings of the back of the aurelia. After this, the butterfly, as if fatigued with its struggles, remains very quiet for some sime, with its wings pointed downwards, and its legs fixed in the skin which it had just thrown off. At first sight the animal, just set free, and permitted the future use of its wings, seems to want them entirely: they take up such little room, that one would wonder where they were hidden. But soon after, they expand so rapidly that the eye can scarcely attend their unfolding. From reaching scarcely half the length of the body, they acquire, in a most wonderful manner, their full extent and bigness, so as to be each five times larger than they were before. Nor is it the wings alone that are thus increased: all their spots and paintings, before so minute as to be scarcely discernible, are proportionably extended; so that, what a few minutes before seemed only a number of confused, unmeaning points, now become distinct and most beautiful ornaments. Nor are the wings, when they are thus expanded, unfolded in the manner in which earwigs and grass-

hoppers display theirs, who unfurl them like a lady's fan: on the contrary, those of butterflies actually grow to their natural size in this very short space. The wing, at the instant it is freed from its late confinement, is considerably thicker than afterwards; so that it spreads in all its dimensions, growing thinner as it becomes broader. If one of the wings be plucked from the animal just set free, it may be spread by the fingers, and it will soon become as broad as the other, which has been left behind. As the wings extend themselves so suddenly, they have not yet had time to dry; and accordingly appear like pieces of wet paper, soft, and full of wrinkles. In about half an hour, they are perfectly dry, their wrinkles entirely disappear, and the little animal assumes all its splendor. The transmutation being thus perfectly finished, the butterfly discharges three or four drops of a blood-coloured liquid, which are the last remains of its superfluous moisture.* Those aurelias which are enclosed within a cone, find that exit more difficult, as they have still another prison to break through: this, however, they perform in a short time; for the butterfly, freed from its aurelia

[* These red drops, which several of the Butterfly Tribe discharge immediately upon their transformation, have been recorded by ancient writers, as showers of blood, portending some convulsion of nature, or national calamity. In the year 1608, the inhabitants of the town of Aix were in the utmost consternation, in consequence of a discharge of this kind, which fell in the suburbs and for some miles round. But the philosopher Pieresc soon quieted their alarms, by shewing them that the whole of this wonder originated in a flight of harmless butterflies, that had just taken wing from their crysalis state.]

skin, butts with its head violently against the walls of its artificial prison; and probably with its eyes, that are rough and like a file, it rubs the internal surface away; till it is at last seen bursting its way into open light; and, in less than a quarter of an hour, the animal acquires its full perfection.

Thus, to use the words of Swammerdam, we see a little insignificant creature distinguished, in its last birth, with qualifications and ornaments, which man, during his stay upon earth, can never even hope to acquire. The butterfly, to enjoy life, needs no other food but the dews of heaven; and the honeyed juices which are distilled from every flower. The pageantry of princes cannot equal the ornaments with which it is invested; nor the rich colouring that embellishes its wings. The skies are the butterfly's proper habitation, and the air its element: whilst man comes into the world naked, and often roves about without habitation or shelter; exposed, on one hand, to the heat of the sun; and, on the other, to the damps and exhalations of the earth; both alike enemies of his happiness and existence.—A strong proof that, while this little animal is raised to its greatest height, we are as yet, in this world, only candidates for perfection!

CHAP. III.

Of Butterflies and Moths.

IT has been already shewn, that all Butterflies are bred from caterpillars; and we have exhibited the various circumstances of that surprising change. It has been remarked, that butterflies may be easily distinguished from flies of every other kind, by their wings; for, in others they are either transparent, like gauze, as we see in the common flesh-fly; or they are hard and crusted, as we see in the wings of the beetle. But in the butterfly, the wings are soft, opake, and painted over with a beautiful dust, that comes off with handling.

The number of these beautiful animals is very great; and though Linnæus has reckoned up above seven hundred and sixty different kinds, the catalogue is still very incomplete. Every collector of butterflies can shew undescribed species: and such as are fond of minute discovery, can here produce animals that have been examined only by himself. In general, however, those of the warm climates are larger and more beautiful than such as are bred at home; and we can easily admit the beauty of the butterfly, since we are thus freed from the damage of the caterpillar. It has been the amusement of some to collect these animals, from different parts of the world; or to breed them from caterpillars at

home. These they arrange in systematic order; or dispose so as to make striking and agreeable pictures: and all must grant, that this specious idleness is far preferable to that unhappy state which is produced by a total want of employment.

The wings of butterflies, as was observed, fully distinguish them from flies of every other kind. They are four in number; and though two of them be cut off, the animal can fly with the two others remaining. They are, in their own substance, transparent; but owe their opacity to the beautiful dust with which they are covered; and which has been likened, by some naturalists, to the feathers of birds; by others, to the scales of fishes; as their imaginations were disposed to catch the resemblance. In fact, if we regard the wing of a butterfly with a good microscope, we shall perceive it studded over with a variety of little grains of different dimensions and forms, generally supported upon a footstalk, regularly laid upon the whole surface. Nothing can exceed the beautiful and regular arrangement of these little substances; which thus serve to paint the butterfly's wing, like the tiles of an house. Those of one rank are a little covered by those that follow, they are of many figures: on one part of the wing may be seen a succession of oval studs; on another part, a cluster of studs, each in the form of an heart: in one place they resemble a hand open, and in another they are long or triangular; while all are interspersed with taller studs, that grow between the rest, like mushrooms upon a stalk. The wing itself is composed of several thick nerves, which render the construction very strong, though light; and

though it be covered over with thousands of these scales or studs, yet its weight is very little encreased by the number. The animal is with ease enabled to support itself a long while in air, although its flight be not very graceful. When it designs to fly to a considerable distance, it ascends and descends alternately; going sometimes to the right, sometimes to the left, without any apparent reason. Upon closer examination, however, it will be found that it flies thus irregularly in pursuit of its mate; and as dogs bait and quarter the ground in pursuit of their game, so these insects traverse the air, in pursuit of their mates, whom they can discover at more than a mile's distance.

If we prosecute our description of the butterfly, the animal may be divided into three parts; the head, the corslet, and the body.

The body is the hinder part of the butterfly, and is composed of rings, which are generally concealed under long hair, with which that part of the animal is cloathed, The corslet is more solid than the rest of the body, because the fore wings, and the legs, are fixed therein. The legs are six in number, although four only are made use of by the animal; the two fore legs being often so much concealed in the long hair of the body, that it is sometimes difficult to discover them. If we examine these parts internally, we shall find the same set of vessels in the butterfly that we observed in the caterpillar, but with this great difference; that as the blood, or humours, in the caterpillar, circulated from the tail to the head, they are found, in the butterfly, to take a direct contrary course, and to circulate from the

head to the tail; so that the caterpillar may be considered as the embryo animal, in which, as we have formerly seen, the circulation is carried on differently from what it is in animals when excluded.

But leaving the other parts of the butterfly, let us turn our attention particularly to the head. The eyes of butterflies have not all the same form; for, in some they are large, in others small; in some they are the larger portion of a sphere, in others they are but a small part of it, and just appearing from the head. In all of them, however, the outward coat has a lustre, in which may be discovered the various colours of the rainbow. When examined a little closely, it will be found to have the appearance of a multiplying-glass; having a great number of sides, or facets, in the manner of a brilliant cut diamond. In this particular, the eye of the butterfly, and of most other insects, entirely correspond; and Leuwenhoek pretends, there are above six thousand facets on the cornea of a flea. These animals, therefore, see not only with great clearness, but view every object multiplied in a surprising manner. Puget adapted the cornea of a fly in such a position, as to see objects through it by the means of a microscope; and nothing could exceed the strangeness of its representations: a soldier, who was seen through it, appeared like an army of pigmies; for while it multiplied, it also diminished the object: the arch of a bridge exhibited a spectacle more magnificent than human skill could perform; the flame of a candle seemed a beautiful illumination. It still, however, remains a doubt, whether

the insect sees objects singly, as with one eye; or, whether every facet is itself a complete eye, exhibiting its own object distinct from all the rest.

Butterflies, as well as most other flying insects, have two instruments, like horns, on their heads, which are commonly called feelers. They differ from the horns of greater animals, in being moveable at their base; and in having a great number of joints, by which means the insect is enabled to turn them in every direction. Those of butterflies are placed at the top of the head, pretty near the external edge of each eye. What the use of these instruments may be, which are thus formed with so much art, and by a Workman who does nothing without reason, is as yet unknown to man. They may serve to guard the eye; they may be of use to clean it; or they may be the organ of some sense which we are ignorant of: but this is only explaining one difficulty by another.

We are not so ignorant of the uses of the trunk, which few insects of the butterfly kind are without. This instrument is placed exactly between the eyes; and when the animal is not employed in seeking its nourishment, it is rolled up, like a curl. A butterfly, when it is feeding, flies round some flower, and settles upon it. The trunk is then uncurled, and thrust out either wholly or in part; and is employed in searching the flower to its very bottom, let it be ever so deep. This search being repeated seven or eight times, the butterfly then passes to another; and continues to hover over those agreeable to its taste, like a bird over its prey. This trunk consists

of two equal hollow tubes, nicely joined to each other, like the pipes of an organ.

Such is the figure and conformation of these beautiful insects, that cheer our walks, and give us the earliest intimations of summer. But it is not by day alone that they are seen fluttering wantonly from flower to flower, as the greatest number of them fly by night, and expand the most beautiful colouring at those hours when there is no spectator. This tribe of insects has therefore been divided into Diurnal and Nocturnal Flies; or, more properly speaking, into Butterflies and Moths: 'the one only flying by day, the other most usually on the wing in the night. They may be easily distinguished from each other, by their horns or feelers: those of the butterfly being clubbed, or knobbed at the end; those of the moth, tapering finer and finer to a point. To express it technically—the feelers of butterflies are clavated; those of moths are filiform.

The butterflies, as well as the moths, employ the short life assigned them, in a variety of enjoyments. Their whole time is spent either in quest of food, which every flower offers; or in pursuit of the female, whose approach they can often perceive at above two miles distance. Their sagacity in this particular is not less astonishing than true; but by what sense they are thus capable of distinguishing each other at such distances, is not easy to conceive. It cannot be by the sight, since such small objects as they are must be utterly imperceptible at half the distance at which they perceive each other: it can scarcely be by the sense of smelling, since the animal has no organs for that purpose. Whatever be their powers of perception, certain it is, that the

male, after having fluttered, as if carelessly, about for some time, is seen to take wing, and go forward, sometimes for two miles together, in a direct line to where the female is perched on a flower.

The general rule among insects is, that the female is larger than the male; and this obtains particularly in the tribe I am describing. The body of the male is smaller and slenderer; that of the female more thick and oval. Previous to the junction of these animals, they are seen sporting in the air, pursuing and flying from each other, and preparing, by a mock combat, for the more important business of their lives. If they be disturbed while united, the female flies off with the male on her back, who seems entirely passive upon the occasion.

But the females of many moths and butterflies seem to have assumed their airy form for no other reason but to fecundate their eggs, and lay them. They are not seen fluttering about in quest of food, or a mate: all that passes, during their short lives, is a junction with the male of about half an hour; after which they deposit their eggs, and die, without taking any nourishment, or seeking any. It may be observed, however, that in all the females of this tribe, they are impregnated by the male by one aperture, and lay their eggs by another.

The eggs of female butterflies are disposed in the body like a bed of chaplets; which, when excluded, are usually oval, and of a whitish colour: some, however, are quite round; and others flatted like a turnip. The covering or shell of the egg, though solid, is thin and transparent; and in proportion as the caterpillar grows within the egg, the colours

change, and are distributed differently. The butterfly seems very well instructed by nature in its choice of the plant or the leaf, where it shall deposit its burthen. Each egg contains but one caterpillar; and it is requisite that this little animal, when excluded, should be near its peculiar provision. The butterfly, therefore, is careful to place her brood only upon those plants that afford good nourishment to its posterity. Though the little winged animal has been fed itself upon dew, or the honey of flowers, yet it makes choice for its young of a very different provision, and lays its eggs on the most unsavoury plants; the ragweed, the cabbage, or the nettle. Thus every butterfly chuses not the plant most grateful to it in its winged state; but such as it has fed upon in its reptile form.

All the eggs of butterflies are attached to the leaves of the favourite plant, by a sort of size or glue; where they continue, unobserved, unless carefully sought after. The eggs are sometimes placed round the tender shoots of plants, in the form of bracelets, consisting of above two hundred in each, and generally surrounding the shoot, like a ring upon a finger. Some butterflies secure their eggs from the injuries of air, by covering them with hair, plucked from their own bodies, as birds sometimes are seen to make their nests; so that their eggs are thus kept warm, and also entirely concealed.

All the tribe of female moths lay their eggs a short time after they leave the aurelia; but there are many butterflies that flutter about the whole summer, and do not think of laying, till the winter begins to warm them of their approaching end: some

even continue the whole winter in the hollows of trees, and do not provide for posterity until the beginning of April, when they leave their retreats, deposit their eggs, and die. Their eggs soon begin to feel the genial influence of the season: the little animals burst from them in their caterpillar state, to become aurelias, and butterflies in their turn, and thus to continue the round of nature.

CHAP. IV.

Of the Enemies of the Caterpillar.

NATURE, though it has rendered some animals surprisingly fruitful, yet ever takes care to prevent their too great increase. One set of creatures is generally opposed to another: and those are chiefly the most prolific that are, from their imbecility, incapable of making any effectual defence. The caterpillar has perhaps, of all other animals, the greatest number of enemies; and seems only to exist by its surprising fecundity. Some animals devour them by hundreds; others, more minute, yet more dangerous, mangle them in various ways: so that, how great soever their numbers may be, their destroyers are in equal proportion. Indeed, if we consider the mischiefs these reptiles are capable of occasioning, and the various damages we sustain from their insatiable rapacity, it is happy for the other ranks of nature, that there are thousands of fishes, birds, and

even insects, that live chiefly upon caterpillars, and make them their most favourite repast.

When we described the little birds that live in our gardens, and near our houses, as destructive neighbours, sufficient attention was not paid to the services which they are frequently found to render us. It has been proved, that a single sparrow and its mate, that have young ones, destroy above three thousand caterpillars in a week; not to mention several butterflies, in which numberless caterpillars are destroyed in embryo. It is in pursuit of these reptiles that we are favoured with the visits of many of our most beautiful songsters, that amuse us during their continuance, and leave us when the caterpillars disappear.

The maxim which has often been urged against man, that he, of all other animals, is the only creature that is an enemy to his own kind, and that the human species only are found to destroy each other, has been adopted by persons who never considered the history of insects. Some of the caterpillar kind in particular, that seem fitted only to live upon leaves and plants, will, however, eat each other; and the strongest will devour the weak, in preference to their vegetable food. That which lives upon the oak, is found to seize any of its companions, which it conveniently can, by the first rings, and inflict a deadly wound: it then feasts in tranquillity on its prey, and leaves nothing of the animal but the husk.

But it is not from each other they have most to fear, as in general they are inoffensive; and many of this tribe are found to live in a kind of society. Many kind of flies lay their eggs either upon, or

within their bodies; and as these turn into worms, the caterpillar is seen to nourish a set of intestine enemies within its body, that must shortly be its destruction: Nature having taught flies, as well as all other animals, the surest methods of perpetuating their kind. "Towards the end of August," says Reaumur, "I perceived a little fly, of a beautiful "gold colour, busily employed in the body of a "large caterpillar, of that kind which feeds upon "cabbage. I gently separated that part of the leaf "on which these insects were placed, from the rest "of the plant, and placed it where I might observe "them more at my ease. The fly, wholly taken up "by the business in which it was employed, walked "along the caterpillar's body, now and then re-"maining fixed to a particular spot. Upon this "occasion, I perceived it every now and then dart "a sting, which it carried at the end of its tail, into "the caterpillar's body, and then drew it out again, "to repeat the same operation in another place. It "was not difficult for me to conjecture the business "which engaged this animal so earnestly; its whole "aim was to deposit its eggs in the caterpillar's "body; which was to serve as a proper retreat for "bringing them to perfection. The reptile thus "rudely treated, seemed to bear all very patiently, "only moving a little when stung too deeply; "which, however, the fly seemed entirely to disre-"gard. I took particular care to feed this caterpillar; "which seemed to me to continue as voracious and "vigorous as any of the rest of its kind. In about "ten or twelve days, it changed into an aurelia, "which seemed gradually to decline, and died: "upon examining its internal parts, the animal was

"entirely devoured by worms; which, however, "did not come to perfection, as it is probable they "had not enoughto sustain them within."

What the French philosopher perceived upon this occasion, is every day to be seen in several of the larger kinds of caterpillars, whose bodies serve as a nest to various flies, that very carefully deposit their eggs within them. The large cabbage caterpillar is so subject to its injuries, that, at certain seasons, it is much easier to find them with than without them. The ichneumon fly, as it is called, particularly infests these reptiles, and prevents their fecundity. This fly is of all others the most formidable to insects of various kinds. The spider, that destroys the ant, the moth, and the butterfly, yet often falls a prey to the ichneumon; who pursues the robber to his retreat, and, despising his nets, tears him in pieces, in the very labyrinth he has made. This insect, as redoubtable as the little quadruped that destroys the crocodile, has received the same name; and from its destruction of the caterpillar tribe, is probably more serviceable to mankind. The insect, I say, makes the body of the caterpillar the place for depositing its eggs, to the number of ten, fifteen or twenty. As they are laid in those parts which are not mortal, the reptile still continues to live, and to feed, shewing no signs of being incommoded by its new guests. The caterpillar changes its skin; and sometimes undergoes the great change into an aurelia; but still the fatal intruders work within, and secretly devour its internal substance: soon after they are seen bursting through its skin, and moving away, in order to spin themselves a covering, previous to their own little transformation. It is indeed

astonishing sometimes to see the number of worms, and those pretty large, that thus issue from the body of a single caterpillar, and eat their way through its skin: but it is more extraordinary still, that they should remain within the body, devouring its entrails, without destroying its life. The truth is, they seem instructed by nature not to devour its vital parts; for they are found to feed only upon that fatty substance which composes the largest part of the caterpillar's body. When this surprising appearance was first observed, it was supposed that the animal thus gave birth to a number of flies, different from itself; and that the same caterpillar sometimes bred an ichneumon, and sometimes a butterfly: but it was not till after more careful inspection, it was discovered, that the ichneumon tribe were not the caterpillar's offspring, but its murderers.

CHAP. V.

Of the Silkworm.

HAVING mentioned, in the last chapter, the damages inflicted by the caterpillar tribe, we now come to an animal of this kind, that alone compensates for all the mischief occasioned by the rest. This little creature, which only works for itself, has been made of the utmost service to man; and furnishes him with a covering more beautiful than

any other animal can supply. We may declaim indeed against the luxuries of the times, when silk is so generally worn; but were such garments to fail, what other arts could supply their deficiency?

Though silk was anciently brought in small quantities to Rome, yet it was so scarce as to be sold for its weight in gold; and was considered as such a luxurious refinement in dress, that it was infamous for a man to appear in habits of which silk formed but half the composition. It was most probably brought among them from the remotest parts of the East; since it was, at the time of which I am speaking, scarcely known even in Persia.

Nothing can be more remote from the truth, than the manner in which their historians describe the animal by which silk is produced. Pausanias informs us, that silk came from the country of the Seres, a people of Asiatic Scythia; in which place an insect, as large as the beetle, but in every other respect resembling a spider, was bred up for that purpose. They take great care, as he assures us, to feed and defend it from the weather; as well during the summer's heat, as the rigours of winter. This insect, he observes, makes its web with its feet, of which it has eight in number. It is fed, for the space of four years, upon a kind of paste prepared for it; and at the beginning of the fifth, it is supplied with the leaves of the green willow, of which it is particularly fond. It then feeds till it bursts with fat; after which they take out its bowels, which are spun into the beautiful manufacture so scarce and costly.

The real history of this animal was unknown among the Romans till the times of Justinian; and it is supposed, that silkworms were not brought into Europe till the beginning of the twelfth century; when Roger of Sicily brought workmen in this manufacture from Asia Minor, after his return from his expedition to the Holy Land, and settled them in Sicily and Calabria. From these the other kingdoms of Europe learned this manufacture; and it is now one of the most lucrative carried on among the southern provinces of Europe.

The silkworm is now very well known to be a large caterpillar, of a whitish colour, with twelve feet, and producing a butterfly of the moth kind. The cone on which it spins, is formed for covering it while it continues in the aurelia state; and several of these, properly wound off, and united together, form those strong and beautiful threads, which are woven into silk. The feeding these worms, the gathering, the winding, the twisting, and the weaving their silk, is one of the principal manufactures of Europe; and, as our luxuries increase, seems every day to become more and more necessary to human happiness.

There are two methods of breeding silkworms; for they may be left to grow, and remain at liberty upon the trees where they are hatched; or they may be kept in a place built for that purpose, and fed every day with fresh leaves. The first method is used in China, Tonquin, and other hot countries; the other is used in those places where the animal has been artificially propagated, and still continues a stranger. In the warm climates, the silkworm proceeds from an egg, which has been glued by the

parent moth upon proper parts of the mulberry-tree, and which remains in that situation during the winter. The manner in which they are situated and fixed to the tree, keeps them unaffected by the influence of the weather; so that those frosts which are severe enough to kill the tree, have no power to injure the silkworm.

The insect never proceeds from the egg till Nature has provided it a sufficient supply; and till the budding leaves are furnished, in sufficient abundance, for its support. When the leaves are put forth, the worm seems to feel the genial summons, and bursting from their little eggs, crawl upon the leaves, where they feed with a most voracious appetite. Thus they become larger by degrees; and after some months feeding, they lay, upon every leaf, small bundles, or cones of silk, which appear like so many golden apples, painted on a fine green ground. Such is the method of breeding them in the East; and without doubt it is best for the worms, and least troublesome for the feeder of them. But it is otherwise in our colder European climates; the frequent changes of the weather, and the heavy dews of our evenings, render the keeping them all night exposed subject to so many inconveniences, as to admit of no remedy. It is true, that by the assistance of nets, they may be preserved from the insults of birds; but the severe cold weather, which often succeeds the first heats of summer as well as the rain and high winds, will destroy them all: and, therefore, to breed them in Europe they must be sheltered and protected from every external injury.

For this purpose, a room is chosen, with a south aspect; and the windows are so well glazed, as not to admit the least air: the walls are well built, and the planks of the floor exceeding close, so as to admit neither birds nor mice, nor even so much as an insect. In the middle there should be four pillars erected, or four wooden posts, so placed as to form a pretty large square. Between these are different stories made with ozier hurdles; and under each hurdle there should be a floor, with an upright border all round. These hurdles and floors must hang upon pullies, so as to be placed, or taken down at pleasure.

When the worms are hatched, some tender mulberry leaves are provided, and placed in the cloth or paper box in which the eggs were laid, and which are large enough to hold a great number. When they have acquired some strength, they must be distributed on beds of mulberry-leaves, in the different stories of the square in the middle of the room, round which a person may freely pass on every side. They will fix themselves to the leaves, and afterwards to the sticks of the hurdles, when the leaves are devoured. They have then a thread, by which they can suspend themselves on occasion, to prevent any shock by a fall; but this is by no means to be considered as the silk which they spin afterwards in such abundance. Care must be taken that fresh leaves be brought every morning, which must be strewed very gently and equally over them; upon which the silkworms will forsake the remainder of the old leaves, which must be carefully taken away, and every thing kept very clean; for nothing hurts these insects so much as moisture and uncleanliness. For

this reason their leaves must be gathered when the weather is dry, and kept in a dry place, if it be necessary to lay in a store. As these animals have but a short time to live, they make use of every moment, and almost continually are spinning, except at those intervals when they change their skins. If mulberry leaves be difficult to be obtained, the leaves of lettuce or holyoak will sustain them: but they do not thrive so well upon their new diet; and their silk will neither be so copious, nor of so good a quality.

Though the judicious choice, and careful management of their diet, is absolutely necessary, yet there is another precaution of equal importance, which is to give them air, and open their chamber windows, at such times as the sun shines warmest. The place also must be kept as clean as possible; not only the several floors that are laid to receive their ordure, but the whole apartments in general. These things well observed, contribute greatly to their health and increase.

The worm, at the time it bursts the shell, is extremely small, and of a black colour; but the head is of a more shining black than the rest of the body; some days after, they begin to turn whitish, or of an ash-coloured grey. After the skin begins to grow too rigid, or the animal is stinted within it, the insect throws it off, and appears cloathed a-new; it then becomes larger and much whiter, though it has a greenish cast: after some days, which are more or less, according to the different heat of the climate, or to the quality of the food, it leaves off eating, and seems to sleep for two days together: then it begins to stir, and put itself into violent mo-

tions, till the skin falls off the second time, and is thrown aside by the animal's feet. All these changes are made in three weeks or a month's time; after which it begins to feed once more, still in its caterpillar form, but a good deal differing from itself before its change. In a few days time it seems to sleep again; and, when it awakes, it again changes its cloathing, and continues feeding as before. When it has thus taken a sufficiency of food, and its parts are disposed for assuming the aurelia form, the animal forsakes, for the last time, all food and society, and prepares itself a retreat to defend it from external injuries, while it is seemingly deprived of life and motion.

This retreat is no other than its cone, or ball of silk, which Nature has taught it to compose with great art; and within which it buries itself, till it assumes its winged form. This cone or ball is spun from two little longish kinds of bags that lie above the intestines, and are filled with a gummy fluid, of a marigold colour. This is the substance of which the threads are formed; and the little animal is furnished with a surprising apparatus for spinning it to the degree of fineness which its occasions may require. This instrument in some measure resembles a wire-drawer's machine, in which gold or silver threads are drawn to any degree of minuteness; and through this the animal draws its thread with great assiduity. As every thread proceeds from two gum-bags, it is probable that each supplies its own; which, however, are united, as they proceed from the animal's body. If we examine the thread with a microscope, it will be found that it is flatted on one side, and grooved along its length: from hence

we may infer, that it is doubled just upon leaving the body; and that the two threads stick to each other by that gummy quality of which they are possessed. Previous to spinning its web, the silkworm seeks out some convenient place to erect its cell, without any obstruction. When it has found a leaf, or a chink fitted to its purpose, it begins to wreathe its head in every direction, and fastens its thread on every side to the sides of its retreat. Though all its first essays seem perfectly confused, yet they are not altogether without design: there appears, indeed, no order or contrivance in the disposal of its first threads; they are by no means laid artfully over each other, but are thrown out at random, to serve as an external shelter against rain; for Nature having appointed the animal to work upon trees in the open air, its habits remain, though it is brought up in a warm apartment.

Malpighi pretends to have observed six different layers in a single cone of silk: but what may easily be observed is, that it is composed externally of a kind of rough cotton-like substance, which is called floss; within the thread is more distinct and even; and next the body of the aurelia, the apartment seems lined with a substance of the hardness of paper, but of a much stronger consistence. It must not be supposed, that the thread which goes to compose the cone is rolled round, as we roll a bottom; on the contrary, it lies upon it in a very irregular manner, and winds off now from one side of the cone, and then from the other. This whole thread, if measured, will be found about three hundred yards long; and so very fine, that eight or ten of them are generally rolled off into one by the ma-

nufacturers. The cone, when completed, is in form like a pigeon's egg, and more pointed at one end than the other; at the smaller end, the head of the aurelia is generally found; and this is the place that the insect, when converted into a moth, is generally seen to burst through.

It is generally a fortnight or three weeks before the aurelia is changed into a moth; but no sooner is the winged insect completely formed, than having divested itself of its aurelia skin, it prepares to burst through its cone, or outward prison: for this purpose it extends its head towards the point of the cone, butts with its eyes, which are rough, against the lining of its cell, wears it away, and at last pushes forward, through a passage which is small at first, but which enlarges as the animal increases its efforts for emancipation; while the tattered remnants of its aurelia skin lie in confusion within the cone, like a bundle of dirty linen.

The animal, when thus set free from its double confinement, appears exhausted with fatigue, and seems produced for no other purpose but to transmit a future brood. It neither flies nor eats; the male only seeking the female, whose eggs he impregnates; and their union continues for four days, without interruption. The male dies immediately after separation from his mate; and she survives him only till she has laid her eggs, which are not hatched into worms till the ensuing spring.

However, there are few of these animals suffered to come to a state of maturity; for as their bursting through the cone destroys the silk, the manufacturers take care to kill the aurelia, by exposing it to the sun, before the moth comes to perfection. This

done, they take off the floss, and throw the cones into warm water, stirring them 'till the first thread offers them a clue for winding all off. They generally take eight of the silken threads together; the cones are still kept under water, till a proper quantity of the silk is wound off: however, they do not take all; for the latter parts grow weak, and are of a bad colour. As to the paper-like substance which remains, some stain it with a variety of colours, to make artificial flowers; others let it lie in the water, till the glutinous matter which cements it is all dissolved: it is then carded like wool, spun with a wheel, and converted into silk stuffs of an inferior kind.

A

HISTORY

OF

INSECTS.

PART IV.

CHAP. I.

Of the Fourth Order of Insects.

IN the foregoing part we treated of caterpillars changing into butterflies; in the present will be given the history of grubs changing into their corresponding winged animals. These, like the former, undergo their transformation, and appear as grubs or maggots, as aurelias, and at last as winged insects. Like the former, they are bred from eggs; they feed in their reptile state; they continue motionless and lifeless, as aurelias; and fly and propagate, when furnished with wings. But they differ in many respects: the grub or maggot wants the number of feet which the caterpillar is seen to have; the aurelia is not so totally wrapped up, but that its feet and its wings appear. The perfect animal, when emancipated, also has its wings either cased, or transparent like gauze; not coloured with that beautifully painted dust which adorns the wings of the butterfly.

In this class of insects, therefore, we may place a various tribe, that are first laid as eggs, then are excluded as maggots or grubs, then change into aurelias, with their legs and wings not wrapped up, but appearing; and lastly, assuming wings, in which state they propagate their kind. Some of these have four transparent wings, as bees; some have two membranous cases to their wings, as beetles; and

some have but two wings, which are transparent, as ants. Here, therefore, we will place the Bee, the Wasp, the Humble Bee, the Ichneumon Fly, the Gnat, the Tipula or Longlegs, the Beetle, the May-Bug, the Glow-Worm, and the Ant. The transformations which all these undergo, are pretty nearly similar; and though very different animals in form, are yet produced nearly in the same manner.

CHAP. II.

Of the Bee.

TO give a complete history of this insect in a few pages, which some have exhausted volumes in describing, and whose nature and properties still continue in dispute, is impossible. It will be sufficient to give a general idea of the animal's operations; which, though they have been studied for more than two thousand years, are still but incompletely known. The account given us by Reaumur is sufficiently minute; and, if true, sufficiently wonderful: but I find many of the facts which he relates doubted by those who are most conversant with bees; and some of them actually declared not to have a real existence in nature.

It is unhappy, therefore, for those whose method demands an history of bees, that they are unfurnished with those materials which have induced so many observers to contradict so great a naturalist.

His life was spent in the contemplation; and it requires an equal share of attention, to prove the error of his discoveries. Without entering, therefore, into the dispute, I will take him for my guide; and just mention, as I go along, those particulars in which succeeding observers have begun to think him erroneous. Which of the two are right, time only can discover; for my part I have only heard one side, for as yet none have been so bold as openly to oppose Reaumur's delightful researches.

There are three different kinds of bees in every hive. First, the labouring bees, which make up the far greatest number, and are thought to be neither male or female, but merely born for the purposes of labour, and continuing the breed, by supplying the young with provision, while yet in their helpless state. The second sort are the drones; they are of a darker colour, longer, and more thick by one third than the former: they are supposed to be the males; and there is not above a hundred of them in a hive of seven or eight thousand bees. The third sort is much larger than either of the former, and still fewer in number: some assert, that there is not above one in every swarm; but this later observers affirm not to be true, there being sometimes five or six in the same hive. These are called queen-bees, and are said to lay all the eggs from which the whole swarm is hatched in a season.

In examining the structure of the common working bee, the first remarkable part that offers is the trunk, which serves to extract the honey from flowers. It is not formed, like that of other flies, in the manner of a tube, by which the fluid is to be sucked up; but like a besom, to sweep, or a tongue,

to lick it away. The animal is furnished also with teeth, which serve it in making wax. This substance is gathered from flowers, like honey; it consists of that dust or farina which contribute to the fecundation of plants, and is moulded into wax by the little animal, at leisure. Every bee, when it leaves the hive to collect this precious store, enters into the cup of the flower, particularly such as seem charged with the greatest quantities of this yellow farina. As the animal's body is covered over with hair, it rolls itself within the flower, and soon becomes quite covered with the dust, which it soon after brushes off with its two hind legs, and kneads into two little balls. In the thighs of the hind legs there are two cavities, edged with hair; and into these, as into a basket, the animal sticks its pellets. Thus employed, the bee flies from flower to flower, increasing its store, and adding to its stock of wax; until the ball upon each thigh becomes as big as a grain of pepper; by this time, having got a sufficient load, it returns, making the best of its way to the hive.

The belly of the bee is divided into six rings, which sometimes shorten the body, by slipping one over the other. It contains within it, beside the intestines, the honey-bag, the venom-bag, and the sting. The honey-bag is as transparent as crystal, containing the honey that the bee has brushed from the flowers; of which the greater part is carried to the hive, and poured into the cells of the honey-comb; while the remainder serves for the bee's own nourishment: for during summer it never touches what has been laid up for winter. The sting, which serves to defend this little animal from its enemies, is composed of three parts; the sheath, and two darts,

which are extremely small and penetrating. Both the darts have several small points or barbs, like those of a fish-hook, which renders the sting more painful, and makes the darts rankle in the wound. Still, however, this instrument would be very slight, did not the bee poison the wound. The sheath, which has a sharp point, makes the first impression; which is followed by that of the darts, and then the venomous liquor is poured in. The sheath sometimes sticks so fast in the wound, that the animal is obliged to leave it behind; by which the bee soon after dies, and the wound is considerably enflamed. It might at first appear well for mankind, if the bee were without its sting; but upon recollection, it will be found that the little animal would then have too many rivals in sharing its labours. An hundred other lazy animals, fond of honey, and hating labour, would intrude upon the sweets of the hive; and the treasure would be carried off, for want of armed guardians to protect it.

From examining the bee singly, we now come to consider it in society, as an animal not only subject to laws, but active, vigilant, laborious, and disinterested. All its provisions are laid up for the community; and all its arts in building a cell, designed for the benefit of posterity. The substance with which bees build their cells is wax; which is fashioned into convenient apartments for themselves and their young. When they begin to work in their hives, they divide themselves into four companies: one of which roves in the fields in search of materials; another employs itself in laying out the bottom and partitions of their cells; a third is employed in making the inside smooth from the corners and angles; and the fourth company bring food for the

rest, or relieve those who return with their respective burthens But they are not kept constant to one employment; they often change the tasks assigned them: those that have been at work, being permitted to go abroad; and those that have been in the fields already, take their places. They seem even to have signs by which they understand each other; for when any of them wants food, it bends down its trunk to the bee from whom it is expected, which then opens its honey-bag, and lets some drops fall into the other's mouth, which is at that time opened to receive it. Their diligence and labour is so great, that, in a day's time, they are able to make cells, that lie upon each other, numerous enough to contain three thousand bees.

If we examine their cells, they will be found formed in the exactest proportion. It was said by Pappus, an ancient geometrician, that, of all other figures hexagons were the most convenient; for, when placed touching each other, the most convenient room would be given, and the smallest loss. The cells of the bees are perfect hexagons: these, in every honeycomb, are double, opening on either side, and closed at the bottom. The bottoms are composed of little triangular panes, which when united together terminate in a point, and lie exactly upon the extremities of other panes of the same shape, in opposite cells. These lodgings have spaces, like streets, between them, large enough to give the bees a free passage in and out; and yet narrow enough to preserve the necessary heat. The mouth of every cell is defended by a border, which makes the door a little less than the inside of the cell, which serves to strengthen the whole. These cells serve for differ-

ent purposes: for laying up their young; for their wax, which in winter becomes a part of their food; and for their honey, which makes their principal subsistence.

It is well known that the habitation of bees ought to be very close; and what their hives want, from the negligence or unskilfulness of man, these animals supply by their own industry: so that it is their principal care, when first hived, to stop up all the crannies. For this purpose they make use of a resinous gum, which is more tenacious than wax, and differs greatly from it. This the ancients called Propolis: it will grow considerably hard in June; though it will in some measure soften by heat; and is often found different in consistence, colour, and smell. It has generally an agreeable aromatic odour when it is warmed; and by some it is considered as a most grateful perfume. When the bees begin to work with it, it is soft, but it requires a firmer consistence every day; till at length it assumes a brown colour, and becomes much harder than wax. The bees carry it on their hinder legs; and some think it is met with on the birch, the willow, and poplar. However it is procured, it is certain that they plaister the inside of their hives with this composition.

If examined through a glass hive, from the hurry the whole swarm is in, the whole at first appears like anarchy and confusion: but the spectator soon finds every animal diligently employed, and following one pursuit, with a settled purpose. Their teeth are the instruments by which they model and fashion their various buildings, and give them such symmetry and perfection. They begin at the top of the hive; and several of them work at a time, at the cells which have two

faces. If they are stinted with regard to time, they give the new cells but half the depth which they ought to have; leaving them imperfect, till they have sketched out the number of cells necessary for the present occasion. The construction of their combs costs them a great deal of labour: they are made by insensible additions; and not cast at once in a mould, as some are apt to imagine. There seems no end of their shaping, finishing, and turning them neatly up. The cells for their young are most carefully formed; those designed for lodging the drones are larger than the rest; and that for the queen-bee, the largest of all. The cells in which the young brood are lodged serve at different times for containing honey; and this proceeds from an obvious cause: every worm, before it is transformed into an aurelia, hangs its old skin on the partitions of its cell; and thus, while it strengthens the wall, diminishes the capacity of its late apartment. The same cell, in a single summer, is often tenanted by three or four worms in succession; and the next season, by three or four more. Each worm takes particular care to fortify the pannels of its cell, by hanging up its spoils there: thus the partitions, being lined six or eight deep, become at last too narrow for a new brood, and are converted into store-houses for honey.

Those cells where nothing but honey is deposited, are much deeper than the rest. When the harvest of honey is so plentiful that they have not sufficient room for it, they either lengthen their combs, or build more; which are much longer than the former. Sometimes they work at three combs at a time; for, when there are three work-houses, more bees

may be thus employed, without embarrassing each other.

But honey, as was before observed, is not the only food upon which these animals subsist. The meal of flowers, of which their wax is formed, is one of their most favourite repasts. This is a diet which they live upon during the summer; and of which they lay up a large winter provision. The wax of which their combs are made, is no more than this meal digested, and wrought into a paste. When the flowers upon which bees generally feed are not fully blown, and this meal or dust is not offered in sufficient quantities, the bees pinch the tops of the stamina in which it is contained, with their teeth; and thus anticipate the progress of vegetation. In April and May the bees are busy, from morning to evening, in gathering this meal; but when the weather becomes too hot in the midst of summer, they work only in the morning.

The bee is furnished with a stomach for its wax, as well as its honey. In the former of the two, their powder is altered, digested and concocted into real wax; and is thus ejected by the same passage by which it was swallowed. Every comb, newly made, is white: but it becomes yellow as it grows old, and almost black when kept too long in the hive. Beside the wax thus digested, there is a large portion of the powder kneaded up for food in every hive, and kept in separate cells, for winter provision. This is called, by the country people, bee-bread; and contributes to the health and strength of the animal during winter. Those who rear bees, may rob them of their honey, and feed them, during the winter, with treacle; but no proper substitute has yet

been found for the bee-bread; and without it, the animals become consumptive and die.

As for the honey, it is extracted from that part of the flower called the nectarium. From the mouth this delicious fluid passes into the gullet; and then into the first stomach, or honey-bag, which, when filled, appears like an oblong bladder. Children, that live in country places, are well acquainted with this bladder; and destroy many bees to come at their store of honey. When a bee has sufficiently filled its first stomach, it returns back to the hive, where it disgorges the honey into one of the cells. It often happens that the bee delivers its store to some other, at the mouth of the hive, and flies off for a fresh supply. Some honeycombs are always left open for common use; but many others are stopped up, till there is a necessity of opening them. Each of these is covered carefully with wax, so close, that the covers seem to be made at the very instant the fluid is deposited within them.

Having thus given a cursory description of the insect, individually considered, and of the habitation it forms, we next come to its social habits and institutions; and, in considering this little animal attentively, after the necessary precautions for the immediate preservation of the community, its second care is turned to the continuance of posterity. How numerous soever the multitude of bees may appear in one swarm, yet they all owe their original to a single parent, which is called the queen-bee. It is indeed surprising that a single insect shall, in one summer, give birth to above twenty thousand young; but, upon opening her body, the wonder will cease, as the number of eggs appearing, at one time,

amounts to five thousand. This animal, whose existence is of such importance to her subjects, may easily be distinguished from the rest, by her size, and the shape of her body. On her safety depends the whole welfare of the commonwealth; and the attentions paid her by all the rest of the swarm, evidently shew the dependence her subjects have upon her security. If this insect be carefully observed, she will be seen at times attended with a numerous retinue, marching from cell to cell, plunging the extremity of her body into many of them, and leaving a small egg in each.

The bees which generally compose her train are thought to be males, which serve to impregnate her by turns. These are larger and blacker than the common bees; without stings, and without industry. They seem formed only to transmit a posterity; and to attend the queen, whenever she thinks proper to issue from the secret retreats of the hive, where she most usually resides. Upon the union of these two kinds depends all expectations of a future progeny; for the working bees are of no sex, and only labour for another offspring: yet such is their attention to their queen, that if she happens to die, they will leave off working, and take no farther care of posterity. If, however, another queen is in this state of universal despair presented them, they immediately acknowledge her for sovereign, and once more diligently apply to their labour. It must be observed, however, that all this fertility of the queen-bee, and the great attentions paid to her by the rest, are controverted by more recent observers. They assert, that the common bees are parents themselves; that they deposit their eggs in the cells which they

have prepared; that the females are impregnated by the males, and bring forth a progeny, which is wholly their own.

However, to go on with their history, as delivered us by Mr. Reaumur—When the queen-bee has deposited the number of eggs necessary in the cells, the working bees undertake the care of the rising posterity. They are seen to leave off their usual employments; to construct proper receptacles for eggs; or to complete those that are already formed. They purposely build little cells, extremely solid, for the young, in which they employ a great deal of wax: those designed for lodging the males, as was already observed, are larger than the rest; and those for the queen-bees the largest of all. There is usually but one egg deposited in every cell; but when the fecundity of the queen is such, that it exceeds the number of cells already prepared, there are sometimes three or four eggs crowded together in the same apartment. But this is an inconvenience that the working bees will by no means suffer. They seem sensible that two young ones, stuffed up in the same cell, when they grow larger, will but embarrass, and at last destroy each other: they therefore take care to leave a cell to every egg; and remove or destroy the rest.

The single egg that is left remaining is fixed to the bottom of the cell, and touches it but in a single point. A day or two after it is deposited, the worm is excluded from the shell of the egg, having the appearance of a maggot rolled up in a ring, and lying softly on a bed of a whitish coloured jelly; upon which also the little animal begins to feed. In the mean time, the instant it appears, the working bees

attend it with the most anxious and parental tenderness; they furnish it every hour with a supply of this whitish substance, on which it feeds and lies; and watch the cell with unremitting care. They are nurses that have a greater affection for the offspring of others, than many parents have for their own children. They are constant in visiting each cell, and seeing that nothing is wanting; preparing the white mixture, which is nothing but a composition of honey and wax, in their own bowels, with which they feed them. Thus attended, and plentifully fed, the worm, in less than six days time, comes to its full growth, and no longer accepts the food offered it. When the bees perceive that it has no further occasion for feeding, they perform the last offices of tenderness, and shut the little animal up in its cell; walling up the mouth of its apartment with wax: where they leave the worm to itself; having secured it from every external injury.

The worm is no sooner left inclosed, but, from a state of inaction, it begins to labour, extending and shortening its body; and by this means lining the walls of its apartment with a silken tapestry, which it spins in the manner of caterpillars, before they undergo their last transformation. When their cell is thus prepared, the animal is soon after transformed into an aurelia; but differing from that of the common caterpillar, as it exhibits not only the legs, but the wings of the future bee, in its present state of inactivity. Thus, in about twenty or one and twenty days after the egg was laid, the bee is completely formed, and fitted to undergo the fatigues of its state. When all its parts have acquired their proper strength and consistence, the young animal

opens its prison, by piercing with its teeth the waxen door that confines it. When just freed from its cell, it is as yet moist, and incommoded with the spoils of its former situation; but the officious bees are soon seen to flock round it, and to lick it clean on all sides with their trunks; while another band, with equal assiduity, are observed to feed it with honey: others again begin immediately to cleanse the cell that has been just left; to carry the ordures out of the hive, and to fit the place for a new inhabitant. The young bee soon repays their care, by its industry; for as soon as ever its external parts become dry, it discovers its natural appetites for labour, and industriously begins the task, which it pursues unremittingly through life. The toil of man is irksome to him, and he earns his subsistence with pain; but this little animal seems happy in its pursuits, and finds delight in all its employments.

When just freed from the cell, and properly equipped by its fellow-bees for duty, it at once issues from the hive, and, instructed only by Nature, goes in quest of flowers, chuses only those that yield it a supply, rejects such as are barren of honey, or have been already drained by other adventurers; and when loaded, is never at a loss to find its way back to the common habitation. After this first sally, it begins to gather the mealy powder that lies on every flower, which is afterwards converted into wax; and with this, the very first day, it returns with two large balls stuck to its thighs.

When bees first begin to break their prisons, there are generally above an hundred excluded in one day. Thus, in the space of a few weeks, the number of the inhabitants in one hive, of moderate size,

becomes so great, that there is no place to contain the new comers; and they are scarcely excluded from the cell, when they are obliged, by the old bees, to sally forth in quest of new habitations. In other words, the hive begins to swarm, and the new progeny prepares for exile.

While there is room enough in the hive, the bees remain quietly together; it is necessity alone that compels the separation. Sometimes, indeed, the young brood, with graceless obstinacy, refuse to depart, and even venture to resist their progenitors. The young ones are known by being browner than the old, with whiter hair; the old ones are of a lighter colour, with red hair. The two armies are therefore easily distinguishable, and dreadful battles are often seen to ensue. But the victory almost ever terminates with strict poetical justice in favour of the veterans, and the rebellious offspring are driven off, not without loss and mutilation.

In different countries, the swarms make their appearance at different times of the year, and there are several signs previous to this intended migration. The night before, an unusual buzzing is heard in the hive; in the morning, though the weather be soft and inviting, they seem not to obey the call, being intent on more important meditations within. All labour is discontinued in the hive, every bee is either employed in forcing, or reluctantly yielding a submission; at length, after some noise and tumult, a queen-bee is chosen, to guard, rather than conduct, the young colony to other habitations, and then they are marshalled without any apparent conductor. In less than a minute, they leave their native abode, and forming a cloud round their protec-

tress, they set off, without seeming to know the place of their destination; *The world before them, where to chuse their place of rest.* The usual time of swarming, is from ten in the morning to three in the afternoon, when the sun shines bright, and invites them to seek their fortunes. They flutter for a while, in the air, like flakes of snow, and sometimes undertake a distant journey, but more frequently are contented with some neighbouring asylum; the branch of a tree, a chimney top, or some other exposed situation. It is, indeed, remarkable, that all those animals, of whatever kind, that have long been under the protection of man, seem to lose a part of their natural sagacity, in providing for themselves. The rabbit, when domesticated, forgets to dig holes, the hen to build a nest, and the bee to seek a shelter, that shall protect it from the inclemencies of winter. In those countries, where the bees are wild, and unprotected by man, they are always sure to build their waxen cells in the hollow of a tree; but with us, they seem improvident in their choice, and the first green branch that stops their flight, seems to be thought sufficient for their abode through winter. However, it does not appear that the queen chuses the place where they are to alight, for many of the stragglers, who seem to be pleased with a particular branch, go and settle upon it; others are seen to succeed, and at last, the queen herself, when she finds a sufficient number there before her, goes to make it the place of her head-quarters. When the queen is settled, the rest of the swarm soon follow; and, in about a quarter of an hour, the whole body seem to be at ease. It sometimes is found, that there are two or three

queens to a swarm, and the colony is divided into parties; but it most usually happens, that one of these is more considerable than the other, and the bees, by degrees, desert the weakest, to take shelter under the most powerful protector. The deserted queen does not long survive this defeat; she takes refuge under the new monarch, and is soon destroyed by her jealous rival. Till this cruel execution is performed, the bees never go out to work; and if there should be a queen-bee, belonging to the new colony, left in the old hive, she always undergoes the fate of the former. However, it must be observed, that the bees never sacrifice any of their queens, when the hive is full of wax and honey; for there is at that time no danger in maintaining a plurality of breeders.

When the swarm is thus conducted to a place of rest, and the policy of government is settled, the bees soon resume their former labours. The making cells, storing them with honey, impregnating the queen, making proper cells for the reception of the rising progeny, and protecting them from external danger, employ their unceasing industry. But soon after, and towards the latter end of summer, when the colony is sufficiently stored with inhabitants, a most cruel policy ensues. The drone bees, which are (as has been said) generally in an hive to the number of an hundred, are marked for slaughter. These, which had hitherto led a life of indolence and pleasure, whose only employment was in impregnating the queen, and rioting upon the labours of the hive, without aiding in the general toil, now share the fate of most voluptuaries, and fall a sacrifice to the general resentment of society.

The working bees, in a body, declare war against them; and in two or three days time, the ground all round the hive is covered with their dead bodies. Nay, the working bees will even kill such drones, as are yet in the worm state, in the cell, and eject their bodies from the hive, among the general carnage.

When an hive sends out several swarms in the year, the first is always the best, and the most numerous. These having the whole summer before them, have the more time for making wax and honey, and consequently their labours are the most valuable to the proprietor. Although the swarm chiefly consists of the youngest bees, yet it is often found, that bees of all ages compose the multitude of emigrants, and it often happens, that bees of all ages are seen remaining behind. The number of them is always more considerable than that of some populous cities, for sometimes upwards of forty thousand are found in a single hive. So large a body may well be supposed to work with great expedition; and in fact, in less than twenty-four hours, they will make combs above twenty inches long, and seven or eight broad. Sometimes they will half fill their hives with wax in less than five days. In the first fifteen days, they are always found to make more wax than they do afterwards during the rest of the year.

Such are the outlines of the natural history of these animals, as usually found in our own country. How they are treated, so as to produce the greatest quantity of honey, belongs rather to the rural œconomist, than the natural historian; volumes have been written on the subject, and still more remains, equally

curious and new. One thing, however, it may be proper to observe, that a farm, or a country, may be over-stocked with bees, as with any other sort of animal; for a certain number of hives always require a certain number of flowers to subsist on. When the flowers near home are rifled, then are these industrious insects seen taking more extensive ranges, but their abilities may be over taxed; and if they are obliged, in quest of honey, to go too far from home, they are over-wearied in the pursuit, they are devoured by birds, or beat down by the winds and rain.

From a knowledge of this, in some parts of France and Piedmont, they have contrived, as I have often seen, a kind of floating bee-house.

They have on board one barge threescore or an hundred bee-hives, well defended from the inclemency of an accidental storm; and with these, the owners suffer themselves to float gently down the river. As the bees are continually chusing their flowery pasture along the banks of the stream, they are furnished with sweets before unrifled; and thus a single floating bee-house yields the proprietor a considerable income. Why a method similar to this has never been adopted in England, where we have more gentle rivers, and more flowery banks, than in any other part of the world, I know not; certainly it might be turned to advantage, and yield the possessor a secure, though perhaps a moderate income.

Having mentioned the industry of these admirable insects, it will be proper to say something of the effects of their labour, of that wax and honey, which are turned by man to such various uses. Bees gather

two kinds of wax, one coarse and the other fine. The coarser sort is bitter, and with this, which is called *propolis*, they stop up all the holes and crevices of their hives. It is of a more resinous nature than the fine wax, and is consequently better qualified to resist the moisture of the season, and preserve the works warm and dry within. The fine wax is as necessary to the animal's preservation as the honey itself. With this they make their lodgings, with this they cover the cells of their young, and in this they lay up their magazines of honey. This is made, as has been already observed, from the dust of flowers, which is carefully kneaded by the little insect, then swallowed, and having undergone a kind of digestion, is formed into the cells, which answer such a variety of purposes. To collect this, the animal rolls itself in the flower it would rob, and thus takes up the vegetable dust with the hair of its body. Then carefully brushing it into a lump, with its fore paws it thrusts the composition into two cavities behind the thighs, which are made like spoons to receive the wax, and the hair that lines them serves to keep it from falling.

As of wax, there are also two kinds of honey, the white and the yellow. The white is taken without fire from the honey-combs. The yellow is extracted by heat, and squeezed through bags, in a press. The best honey is new, thick, and granulated, of a clear transparent white colour, of a soft and aromatic smell, and of a sweet lively taste. Honey made in mountainous countries is preferable to that of the valley. The honey made in the spring, is more highly esteemed than that gathered in summer, which last is still more valuable than that of au-

tumn, when the flowers begin to fade and lose their fragrance.

The bees are nearly alike in all parts of the world, yet there are differences worthy our notice. In Guadaloupe, the bee is less by one half than the European, and more black and round. They have no sting, and make their cells in hollow trees; where, if the hole they meet with is too large, they form a sort of waxen house, of the shape of a pear, and in this they lodge and store their honey, and lay their eggs. They lay up their honey in waxen vessels, of the size of a pigeon's egg, of a black or deep violet colour; and these are so joined together, that there is no space left between them. The honey never congeals, but is fluid, of the consistence of oil, and the colour of amber. Resembling these, there are found little black bees, without a sting, in all the tropical climates; and though these countries are replete with bees, like our own, yet those form the most useful and laborious tribe in that part of the world. The honey they produce, is neither so unpalatable, nor so surfeiting as ours; and the wax is so soft, that it is only used for medicinal purposes, it being never found hard enough to form into candles, as in Europe.

Of insects that receive the name of bees, among us there are several; which, however, differ very widely from that industrious social race we have been just describing. The Humble-Bee is the largest of all this tribe, being as large as the first joint of one's middle finger. These are seen in every field, and perched on every flower. They build their nest in holes in the ground, of dry leaves, mixed with wax and wool, defended with moss from

the weather. Each humble-bee makes a separate cell, about the size of a small nutmeg, which is round and hollow, containing the honey in a bag. Several of these cells are joined together, in such a manner, that the whole appears like a cluster of grapes. The females, which have the appearance of wasps, are very few, and their eggs are laid in cells, which the rest soon cover over with wax. It is uncertain whether they have a queen or not; but there is one much larger than the rest, without wings, and without hair, and all over black, like polished ebony. This goes and views all the works, from time to time, and enters into the cell, as if it wanted to see whether every thing was done right: in the morning, the young humble-bees are very idle, and seem not at all inclined to labour, till one of the largest, about seven o'clock, thrusts half its body from a hole, designed for that purpose, and seated on the top of the nest, beats its wings for twenty minutes successively, buzzing the whole time, till the whole colony is put in motion. The humble-bees gather honey, as well as the common bees; but it is neither so fine nor so good, nor the wax so clean, or so capable of fusion.

Beside the bees already mentioned, there are various kinds among us, that have much the appearance of honey-makers, and yet make only wax. The Wood-Bee is seen in every garden. It is rather larger than the common queen-bee; its body of a bluish black, which is smooth and shining. It begins to appear at the approach of spring, and is seen flying near walls exposed to a sunny aspect. This bee makes its nest in some piece of wood, which it contrives to scoop and hollow for its purpose. This,

however, is never done in trees that are standing, for the wood it makes choice of is half rotten. The holes are not made directly forward, but turning to one side, and having an opening sufficient to admit one's middle finger; from whence runs the inner apartment, generally twelve or fifteen inches long. The instruments used in boring these cavities, are their teeth; the cavity is usually branched into three or four apartments; and in each of these they lay their eggs, to the number of ten or twelve, each separate and distinct from the rest. The egg is involved in a sort of paste, which serves at once for the young animal's protection and nourishment. The grown bees, however, feed upon small insects, particularly a louse, of a reddish brown colour, of the size of a small pin's head.

Mason-Bees make their cells with a sort of mortar, made of earth, which they build against a wall that is exposed to the sun. The mortar, which at first is soft, soon becomes as hard as stone, and in this their eggs are laid. Each nest contains seven or eight cells, an egg in every cell, placed regularly, one over the other. If the nest remains unhurt, or wants but little repairs, they make use of them the year ensuing: and thus they often serve three or four years successively. From the strength of their houses, one would think these bees in perfect security, yet none are more exposed than they. A worm with very strong teeth, is often found to bore into their little fortifications, and devour their young.

The Ground-Bee builds its nest in the earth, wherein they make round holes, five or six inches deep; the mouth being narrow, and only just sufficient to admit the little inhabitant. It is amusing

enough, to observe the patience and assiduity with which they labour. They carry out all the earth, grain by grain, to the mouth of the hole, where it forms a little hillock, an Alps compared to the power of the artist by which it is raised. Sometimes the walks of a garden are found undermined by their labours; some of the holes running directly downward, others horizontally beneath the surface. They lay up in these cavities provisions for their young, which consist of a paste that has the appearance of corn, and is of a sweetish taste.

The Leaf-cutting Bees make their nest and lay their eggs among bits of leaves, very artificially placed in holes in the earth, of about the length of a tooth pick-case. They make the bits of leaves of a roundish form, and with them line the inside of their habitations. This tapestry is still further lined by a reddish kind of paste, somewhat sweet or acid. These bees are of various kinds; those that build their nests with chesnut-leaves are as big as drones, but those of the rose-tree are smaller than the common bee.

The Wall-Bees are so called because they make their nests in walls, of a kind of silky membrane with which they fill up the vacuities between the small stones which form the sides of their habitation. Their apartment consists of several cells, placed end to end, each in the shape of a woman's thimble. Though the web which lines this habitation is thick and warm, yet it is transparent and of a whitish colour. This substance is supposed to be spun from the animal's body; the males and females are of a size, but the former are without a sting. To these varieties of the bee kind might be added several others which

are all different in nature, but not sufficiently distinguished to excite curiosity.

CHAP. III.

Of the Wasp.

HOWEVER similar many insects may be in appearance, this does not imply a similitude in their history. The bee and the wasp resemble each other very strongly, yet, in examining their manner and their duration, they differ very widely; the bee labours to lay up honey, and lives to enjoy the fruits of its induſtry; the wasp appears equally assiduous, but only works for posterity, as the habitation is scarcely completed when the inhabitant dies.

The Wasp is well known to be a winged insect with a sting. To be longer in proportion to its bulk than the bee, to be marked with bright yellow circles round its body, and to be the most swift and active insect of all the fly kind. On each side of the mouth this animal is furnished with a long tooth, notched like a saw, and with these it is enabled to cut any substance, not omitting meat itself, and to carry it to its nest. Wasps live like bees in community, and sometimes ten or twelve thousand are found inhabiting a single nest.

Of all other insects the wasp is the most fierce, voracious, and most dangerous when enraged. They are seen wherever flesh is cutting up, gorging them-

selves with the spoil, and then flying to their nests with their reeking prey. They make war also on every other fly, and the spider himself dreads their approaches.

Every community among bees is composed of females or queens, drones or males, and neutral or working bees. Wasps have similar occupations; the two first are for propagating the species, the last for nursing, defending and supporting the rising progeny. Among bees, however, there is seldom above a queen or two in an hive; among wasps there are above two or three hundred.

As soon as the summer begins to invigorate the insect tribes, the wasps are the most of the number, and diligently employed either in providing provisions for their nest, if already made, or in making one, if the former habitation be too small to receive the encreasing community. The nest is one of the most curious objects in natural history, and contrived almost as artificially as that of the bees themselves. Their principal care is to seek out an hole that has been begun by some other animal, a field mouse, a rat, or a mole, to build their nests in. They sometimes build upon the plain, where they are sure of the dryness of their situation, but most commonly on the side of a bank, to avoid the rain or water that would otherwise annoy them. When they have chosen a proper place they go to work with wonderful assiduity. Their first labour is to enlarge and widen the hole, taking away the earth and carrying it off to some distance. They are perfectly formed for labour, being furnished with a trunk above their mouths, two saws on each side, which play to the right and left against each other, and six strong mus-

cular legs to support them. They cut the earth into small parcels with their saws, and carry it out with their legs or paws. This is the work of some days: and at length the outline of their habitation is formed, making a cavity of about a foot and a half every way. While some are working in this manner, others are roving the fields to seek out materials for their building. To prevent the earth from falling down and crushing their rising city into ruin, they make a sort of roof with their gluey substance, to which they begin to fix the rudiments of their building, working from the top downwards, as if they were hanging a bell, which, however, at length they close up at the bottom. The materials with which they build their nests, are bits of wood and glue. The wood they get where they can from the rails and posts which they meet with in the fields and elsewhere. These they saw and divide into a multitude of small fibres, of which they take up little bundles in their claws, letting fall upon them a few drops of gluey matter with which their bodies are provided, by the help of which they knead the whole composition into a paste, which serves them in their future building. When they have returned with this to the nest, they stick their load of paste on that part where they make their walls and partitions; they tread it close with their feet, and trowel it with their trunks, still going backwards as they work. Having repeated this operation three or four times, the composition is at length flatted out until it becomes a small leaf of a grey colour, much finer than paper, and of a pretty firm texture. This done the same wasp returns to the field to collect a second load of paste, repeating the same several

times, placing layer upon layer, and strengthening every partition in proportion to the wants or convenience of the general fabric. Other working wasps come quickly after to repeat the same operation, laying more leaves upon the former, till at length, after much toil, they have finished the large roof which is to secure them from the tumbling in of the earth. This dome being finished, they make another entrance to their habitation, designed either for letting in the warmth of the sun, or for escaping in case one door be invaded by plunderers. Certain however it is, that by one of these they always enter, by the other they sally forth to their toil; each hole being so small that they can pass but one at a time. The walls being thus composed, and the whole somewhat of the shape of a pear, they labour at their cells, which they compose of the same paper-like substance that goes to the formation of the outside works. Their combs differ from those of bees, not less in the composition than the position which they are always seen to obtain. The honey-comb of the bee is edgeways with respect to the hive; that of the wasp is flat, and the mouth of every cell opens downwards. Thus is their habitation contrived, story above story, supported by several rows of pillars which give firmness to the whole building, while the upper story is flat-roofed, and as smooth as the pavement of a room, laid with squares of marble. The wasps can freely walk upon these stories between the pillars, to do whatever their wants require. The pillars are very hard and compact, being larger at each end than in the middle, not much unlike the columns of a building. All the cells of the nest are

only destined for the reception of the young, being replete with neither wax nor honey.

Each cell is like that of the bee, hexagonal; but they are of two sorts, the one larger for the production of the male and female wasps, the other less for the reception of the working part of the community. When the females are impregnated by the males, they lay their eggs, one in each cell, and stick it in with a kind of gummy matter to prevent its falling out. From this egg proceeds the insect in its worm-state, of which the old ones are extremely careful, feeding it from time to time till it becomes large, and entirely fills up its cell. But the wasp community differs from that of the bee in this, that among the latter the working bees take the parental duties upon them, whereas among the wasps the females alone are permitted to feed their young, and to nurse their rising progeny. For this purpose the female waits with great patience till the working wasps have brought in their provisions, which she takes from them, and cuts into pieces. She then goes with great composure from cell to cell, and feeds every young one with her mouth. When the young worms have come to a certain size they leave off eating, and begin to spin a very fine silk, fixing the first end to the entrance of the cell, then turning their heads, first on one side, then on the other, they fix the thread to different parts, and thus they make a sort of a door which serves to close up the mouth of the cell. After this they divest themselves of their skins after the usual mode of transformation, the aurelia by degrees begins to emancipate itself from its shell: by little and little it thrusts out its legs and

wings, and insensibly acquires the colour and shape of its parent.

The wasp thus formed, and prepared for depredation, becomes a bold, troublesome, and dangerous insect: there are no dangers which it will not encounter in pursuit of its prey, and nothing seems to satiate its gluttony. Though it can gather no honey of its own, no animal is more fond of sweets. For this purpose it will pursue the bee and the humble-bee, destroy them with its sting, and then plunder them of their honey-bag, with which it flies triumphantly loaded to its nest to regale its young. Wasps are ever fond of making their nests in the neighbourhood of bees, merely to have an opportunity of robbing their hives, and feasting on the spoil. Yet the bees are not found always patiently submissive to their tyranny, but fierce battles are sometimes seen to ensue, in which the bees make up by conduct and numbers what they want in personal prowess. When there is no honey to be had, they seek for the best and sweetest fruits, and they are never mistaken in their choice. From the garden they fly to the city, to the grocer's shops, and butcher's shambles. They will sometimes carry off bits of flesh half as big as themselves, with which they fly to their nest for the nourishment of their brood. Those who cannot drive them away, lay for them a piece of ox's liver, which being without fibres, they prefer to other flesh; and whenever they are found, all other flies are seen to desert the place immediately. Such is the dread with which these little animals impress all the rest of the insect tribes, which they seize and devour without mercy, that they vanish at their approach. Wherever they fly, like the eagle

or the falcon, they form a desert in the air around them. In this manner the summer is passed in plundering the neighbourhood, and rearing up their young; every day adds to their numbers; and from their strength, agility, and indiscriminate appetite for every kind of provision, were they as long-lived as the bee, they would soon swarm upon the face of nature, and become the most noxious plague of man: but providentially their lives are measured to their mischief, and they live but a single season.

While the summer heats continue, they are bold, voracious, and enterprising: but as the sun withdraws, it seems to rob them of their courage and activity. In proportion as the cold increases, they are seen to become more domestic; they seldom leave the nest, they make but short adventures from home, they flutter about in the noon-day heats, and soon after return chilled and feeble.

As their calamities increase, new passions soon begin to take place; the care for posterity no longer continues, and as the parents are no longer able to provide their growing progeny a supply, they take the barbarous resolution of sacrificing them all to the necessity of the times. In this manner, like a garrison upon short allowance, all the useless hands are destroyed; the young worms, which a little before they fed and protected with so much assiduity, are now butchered and dragged from their cells. As the cold increases, they no longer find sufficient warmth in their nests, which grow hateful to them, and they fly to seek it in the corners of houses, and places that receive an artificial heat. But the winter is still insupportable; and, before the new year begins, they wither and die; the working wasps

first, the males soon following, and many of the females suffering in the general calamity. In every nest, however, one or two females survive the winter, and having been impregnated by the male during the preceding season, she begins in spring to lay her eggs in a little hole of her own contrivance. This bundle of eggs, which is clustered together like grapes, soon produces two worms, which the female takes proper precaution to defend and supply, and these when hatched soon give assistance to the female, who is employed in hatching two more; these also gathering strength, extricate themselves out of the web that inclosed them, and become likewise assistants to their mother; fifteen days after, two more make their appearance; thus is the community every day increasing, while the female lays in every cell, first a male and then a female. These soon after become breeders in turn, till, from a single female, ten thousand wasps are seen produced before the month of June. After the female has thus produced her progeny, which are distributed in different districts, they assemble from all parts, in the middle of summer, and provide for themselves the large and commodious habitation which has been described above.

Such is the history of the social wasp; but, as among bees, so also among these insects, there are various tribes that live in solitude: these lay their eggs in an hole for the purpose, and the parent dies long before the birth of its offspring. In the principal species of the Solitary Wasps, the insect is smaller than the working wasp of the social kind. The filament, by which the corselet is joined to the body, is longer and more distinctly seen, and the whole co-

lour of the insect is blacker than in the ordinary kinds. But it is not their figure, but the manners of this extraordinary insect that claim our principal regard.

From the end of May to the beginning of July, this wasp is seen most diligently employed. The whole purpose of its life seems to be in contriving and fitting up a commodious apartment for its young one, which is not to succeed it till the year ensuing. For this end it is employed, with unwearied assiduity, in boring an hole into the finest earth some inches deep, but not much wider than the diameter of its own body. This is but a gallery leading to a wider apartment destined for the convenient lodgment of its young. As it always chuses a gravelly soil to work in, and where the earth is almost as hard as stone itself, the digging and hollowing this apartment is an enterprize of no small labour; for effecting its operations, this insect is furnished with two teeth, which are strong and firm, but not sufficiently hard to penetrate the substance through which it is resolved to make its way: in order therefore to soften that earth which it is unable to pierce, it is furnished with a gummy liquor which it emits upon the place, and which renders it more easily separable from the rest, and the whole becoming a kind of soft paste, is removed to the mouth of the habitation. The animal's provision of liquor in these operations is however soon exhausted; and it is then seen either taking up water from some neighbouring flower or stream in order to supply the deficiency.

At length, after much toil, a hole some inches deep is formed, at the bottom of which is a large

cavity; and to this no other hostile insect would venture to find its way, from the length and the narrowness of the defile through which it would be obliged to pass. In this the solitary wasp lays its egg, which is destined to continue the species; there the nascent animal is to continue for above nine months, unattended and immured, and at first appearance the most helpless insect of the creation. But when we come to examine, new wonders offer, no other insect can boast so copiously luxurious a provision, or such confirmed security.

As soon as the mother-wasp has deposited her egg at the bottom of the hole, her next care is to furnish it with a supply of provisions, which may be offered to the young insect as soon as it leaves the egg. To this end she procures a number of little green worms, generally from eight to twelve, and these are to serve as food for the young one the instant it awakens into life. When this supply is regularly arranged and laid in, the old one then, with as much assiduity as it before worked out its hole, now closes the mouth of the passage; and thus leaving its young one immured in perfect security, and in a copious supply of animal food, she dies, satisfied with having provided for a future progeny.

When the young one leaves the egg it is scarcely visible, and is seen immured among a number of insects, infinitely larger than itself, ranged in proper order around it, which, however, give it no manner of apprehension. Whether the parent, when she laid in the insect provision, contrived to disable the worms from resistance, or whether they were at first incapable of any, is not known. Certain it is, that the young glutton feasts upon the living spoil with-

out any controul; his game lies at his hand, and he devours one after the other as the calls of appetite incite him. The life of the young animal is therefore spent in the most luxurious manner, till its whole stock of worms is exhausted, when the time of its transformation begins to approach; and then spinning a silken web, it continues fixed in its cell till the sun calls it from its dark abode the ensuing summer.

The wasps of Europe are very mischievous, yet they are innocence itself when compared to those of the tropical climates, where all the insect tribes are not only numerous, but large, voracious, and formidable. Those of the West Indies are thicker, and twice as long as the common bee; they are of a grey colour, striped with yellow, and armed with a very dangerous sting. They make their cells in the manner of an honeycomb, in which the young ones are hatched and bred. They generally hang their nests by threads, composed of the same substance with the cells, to the branches of trees, and the eaves of houses. They are seen every where in great abundance, descending like fruit, particularly pears, of which shape they are, and as large as one's head. The inside is divided into three round stories, full of cells, each hexagonal, like those of an honeycomb. In some of the islands, these insects are so very numerous, that their nests are stuck up in this manner, scarcely two feet asunder, and the inhabitants are in continual apprehension from their accidental resentment. It sometimes happens, that no precautions can prevent their attacks, and the pain of their sting is almost insupportable. Those who have felt it think it more terrible than even that of a

scorpion; the whole visage swells, and the features are so disfigured, that a person is scarcely known by his most intimate acquaintance.

[The Sand-wasp is found upon warm sand-banks, and is distinguished from others of its tribe, by the abdomen being separated from the thorax by a long stalk; and by the shortness of its wings.

"I observed one of them," says Mr. Ray, "dragging a green caterpillar thrice its own size: it laid this down, near the mouth of a burrow that it had made in the ground; then removing a little ball of earth, with which it had covered the orifice, it first went down itself, and after staying a short time returned, and seizing the caterpillar again, drew it down with him. Then leaving it there, it came up, and taking some little globules of earth, rolled them one by one into the burrow, scraping the dust in by intervals with its fore-feet, in the manner of a dog; thus alternately rolling in pieces of earth, and scraping in dust, till the hole was full; sometimes going down, as it seemed to me to press down the earth; and once or twice flying to a fir-tree which grew near, perhaps to get turpentine to glue it down, and make it firm. The hole being filled, and equalled with the surface of the earth, that its entrance might not be discovered, it took two fir leaves that were near, and laid them by the mouth of the den, most probably to mark the place."]

CHAP. IV.

Of the Ichneumon Fly.

EVERY rank of insects, how voracious soever, have enemies that are terrible to them, and that revenge upon them the injuries done upon the rest of the animated creation. The wasp, as we have seen, is very troublesome to man, and very formidable to the insect tribe; but the ichneumon fly (of which there are many varieties) fears not the wasp itself; it enters its retreats, plunders its habitations, and takes possession of that cell for its own young, which the wasp had laboriously built for a dearer posterity.

Though there are many different kinds of this insect, yet the most formidable, and that best known, is called the Common Ichneumon, with four wings, like the bee, a long slender black body, and a three-forked tail, consisting of bristles; the two outermost black, and the middlemost red. This fly receives its name from the little quadruped, which is found to be so destructive to the crocodile, as it bears a strong similitude in its courage and rapacity.

Though this instrument is, to all appearance, slender and feeble, yet it is found to be a weapon of great force and efficacy. There is scarcely any substance which it will not pierce; and, indeed, it is

seldom seen but employed in penetration. This is the weapon of defence, this is employed in destroying its prey; and still more, by this the animal deposits her eggs wherever she thinks fit to lay them. As it is an instrument chiefly employed for this purpose, the male is unprovided with such a sting, while the female uses it with great force and dexterity, brandishing it when caught, from side to side, and very often wounding those who thought they held her with the greatest security.

All the flies of this tribe are produced in the same manner, and owe their birth to the destruction of some other insect, within whose body they have been deposited, and upon whose vitals they have preyed, till they came to maturity. There is no insect whatever, which they will not attack, in order to leave their fatal present in its body; the caterpillar, the gnat, and even the spider himself, so formidable to others, is often made the unwilling fosterer of this destructive progeny.

About the middle of summer, when other insects are found in great abundance, the ichneumon is seen flying busily about, and seeking proper objects upon whom to depose its progeny. As there are various kinds of this fly, so they seem to have various appetites. Some are found to place their eggs within the aurelia of some nascent insect, others place them within the nest, which the wasp had curiously contrived for its own young; and as both are produced at the same time, the young of the ichneumon not only devours the young wasp, but the whole supply of worms, which the parent had carefully provided for its provision. But the greatest number of the ichneumon tribe are seen settling upon the back of

the caterpillar, and darting, at different intervals, their stings into its body. At every dart they deposit an egg, while the wounded animal seems scarcely sensible of the injury it sustains. In this manner they leave from six to a dozen of their eggs within the fatty substance of the reptile's body, and then fly off to commit further depredations. In the mean time the caterpillar, thus irreparably injured, seems to feed as voraciously as before; does not abate of its usual activity; and, to all appearance, seems no way affected by the internal enemies that are preparing its destruction in their darksome abode. But they soon burst from their egg state, and begin to prey upon the substance of their prison. As they grow larger, they require a greater supply, till at last the animal, by whose vitals they are supported, is no longer able to sustain them, but dies; its whole inside being almost eaten away. It often happens, however, that it survives their worm state, and then they change into a chrysalis, enclosed in the caterpillar's body till the time of their delivery approaches, when they burst their prisons, and fly away. The caterpillar, however, is irreparably destroyed, it never changes into a chrysalis, but dies shortly after, from the injuries it had sustained.

Such is the history of this fly, which, though very terrible to the insect tribe, fails not to be of infinite service to mankind. The millions which it kills in a single summer, are inconceivable; and without such a destroyer the fruits of the earth would only rise to furnish a banquet for the insect race, to the exclusion of all the nobler ranks of animated nature.

CHAP. V.

Of the Ant.

THOUGH the number of two-winged flies be very great, and the naturalists have taken some pains to describe their characters and varieties; yet there is such a similitude in their forms and manners, that in a work like this, one description must serve for all. We now, therefore, come to a species of four-winged insects, that are famous from all antiquity, for their social and industrious habits, that are marked for their spirit of subordination, that are offered as a pattern of parsimony to the profuse, and of unremitting diligence to the sluggard.

In the experiments, however, which have been more recently made, and the observations which have been taken, much of their boasted frugality and precaution seems denied them; the treasures they lay up, are no longer supposed intended for future provision; and the choice they make in their stores, seems no way dictated by wisdom. It is, indeed, somewhat surprising, that almost every writer of antiquity should describe this insect, as labouring in the summer, and feasting upon the produce during the winter. Perhaps, in some of the warmer climates, where the winter is mild, and of short continuance, this may take place; but in France and England these animals can have no manner of occasion for a supply of winter provisions, as

they are actually in a state of torpidity during that season.

The Common Ants of Europe are of two or three different kinds; some red, some black, some with stings, and others without. Such as have stings, inflict their wounds in that manner; such as are unprovided with these weapons of defence, have a power of spurting, from their hinder parts, an acid pungent liquor, which, if it lights upon the skin, inflames and burns it like nettles.

The body of an ant is divided into the head, breast, and belly. In the head, the eyes are placed, which are entirely black, and under their eyes are two small horns or feelers, composed of twelve joints, all covered with a fine silky hair. The mouth is furnished with too crooked jaws, which project outwards, in each of which are seen incisures, that look like teeth. The breast is covered with a fine silky hair, from which project six legs, that are pretty strong and hairy, the extremities of each armed with two small claws, which the animal uses in climbing. The belly is more reddish than the rest of the body, which is of a brown chesnut colour, shining as glass, and covered with extremely fine hair.

From such a formation, this animal seems bolder, and more active, for its size, than any-other of the insect tribe, and fears not to attack a creature, often above ten times its own magnitude.

As soon as the winter is past, in the first fine day in April, the ant-hill, that before seemed a desert, now swarms with new life, and myriads of these insects are seen just awaked from their annual lethargy, and preparing for the pleasures and fatigues of the season. For the first day they never offer to

leave the hill, which may be considered as their citadel, but run over every part of it, as if to examine its present situation, to observe what injuries it has sustained during the rigours of winter*, while they slept, and to meditate and settle the labour's of the day ensuing.

At the first display of their forces, none but the wingless tribe appears, while those furnished with wings remain at the bottom. These are the working ants, that first appear, and that are always destitute of wings; the males and females, that are furnished with four large wings each, are more slow in making their appearance.

Thus, like bees, they are divided into males, females, and the neutral or the working tribe. These are all easily distinguished from each other; the females are much larger than the males; the working ants are the smallest of all. The two former have wings; which, however, they sometimes are divested of; the latter never have any, and upon them are devolved all the labours that tend to the welfare of the community. The female also may be distinguished by the colour and structure of her breast, which is a little more brown than that of the common ant, and a little brighter than that of the male.

In eight or ten days after their first appearance, the labours of the hill are in some forwardness; the males and females are seen mixed with the working multitude, and pursued or pursuing each other. They seem no way to partake in the common drudgeries of the state; the males pursue the females

* Memoires pour servir à l'Histoire des Insectes, par Charles de Geer.

with great assiduity, and in a manner force them to compliance. They remain coupled for some time, while the males thus united suffer themselves to be drawn along by the will of their partners.

In the mean time, the working body of the state take no part in their pleasures; they are seen diligently going from the ant-hill, in pursuit of food for themselves and their associates, and of proper materials for giving a comfortable retreat to their young, or safety to their habitation. In the fields of England, ant-hills are formed with but little apparent regularity. In the more southern provinces of Europe, they are constructed with wonderful contrivance, and offer a sight highly worthy a naturalist's curiosity. These are generally formed in the neighbourhood of some large tree and a stream of water. The one is considered by the animals, as the proper place for getting food; the other for supplying them with moisture, which they cannot well dispense with. The shape of the ant-hill is that of a sugar-loaf, about three feet high, composed of various substances, leaves, bits of wood, sand, earth, bits of gum, and grains of corn. These are all united into a compact body, perforated with galleries down to the bottom, and winding ways within the body of the structure. From this retreat to the water, as well as to the tree, in different directions, there are many paths worn by constant assiduity, and along these the busy insects are seen passing and repassing continually; so that from May, or the beginning of June, according to the state of the season, they work continually, till the bad weather comes on.

The chief employment of the working ants, is in sustaining not only the idlers at home, but also

finding a sufficiency of food for themselves. They live upon various provisions, as well of the vegetable as of the animal kind. Small insects they will kill and devour; sweets of all kinds they are particularly fond of. They seldom, however, think of their community, till they themselves are first satiated. Having found a juicy fruit, they swallow what they can, and then tearing it in pieces, carry home their load. If they meet with an insect above their match, several of them will fall upon it at once, and having mangled it, each will carry off a part of the spoil. If they meet, in their excursions, any thing that is too heavy for one to bear, and yet, which they are unable to divide, several of them will endeavour to force it along; some dragging and others pushing. If any one of them happens to make a lucky discovery, it will immediately give advice to others; and then at once, the whole republic will put themselves in motion. If in these struggles, one of them happens to be killed, some kind survivor will carry him off to a great distance, to prevent the obstructions his body may give to the general spirit of industry.

But while they are thus employed in supporting the state, in feeding abroad, and carrying in provisions to those that continue at home, they are not unmindful of posterity. After a few days of fine weather, the female ants begin to lay their eggs, and those are as assiduously watched and protected by the working ants, who take upon themselves to supply whatever is wanting to the nascent animal's convenience or necessity. They are carried, as soon as laid, to the safest situation, at the bottom of their hill, where they are carefully defended from cold and moisture. We are not to suppose, that those

white substances which we so plentifully find in every ant-hill, are the eggs as newly laid. On the contrary, the ant's egg is so very small, that, though laid upon a black ground, it can scarcely be discerned. The little white bodies we see, are the young animals in their maggot state, endued with life, long since freed from the egg, and often involved in a cone, which it has spun round itself, like the silkworm. The real egg, when laid, if viewed through a microscope, appears smooth, polished and shining, while the maggot is seen composed of twelve rings, and is oftener larger than the ant itself.

It is impossible to express the fond attachment which the working ants shew to their rising progeny. In cold weather they take them in their mouths, but without offering them the smallest injury, to the very depths of their habitation, where they are less subject to the severity of the season. In a fine day they remove them, with the same care, nearer the surface, where their maturity may be assisted by the warm beams of the sun. If a formidable enemy should come to batter down their whole habitation, and crush them by thousands in the ruin, yet these wonderful insects, still mindful of their parental duties, make it their first care to save their offspring. They are seen running wildly about, and different ways, each loaded with a young one, often bigger than the insect that supports it. I have kept, says Swammerdam, several of the working ants in my closet, with their young, in a glass filled with earth. I took pleasure in observing, that in proportion as the earth dried on the surface, they dug deeper and deeper to deposit their eggs; and when

I poured water thereon, it was surprising to see with what care, affection, and diligence they laboured, to put their brood in safety, in the driest place. I have seen also, that when water has been wanting for several days, and when the earth was moistened after it a little, they immediately carried their young ones to have a share, who seemed to enjoy and suck the moisture.

When the young maggot is come to its full growth, the breast swells insensibly, it casts its skin, and loses all motion. All the members which were hidden before, then begin to appear, an aurelia is formed, which represents very distinctly all the parts of the animal, though they are yet without motion, and as it were wrapped up in swaddling-cloaths. When at length, the little insect has passed through all its changes, and acquired its proper maturity, it bursts this last skin, to assume the form it is to retain ever after. Yet this is not done by the efforts of the little animal alone, for the old ones very assiduously break open, with their teeth, the covering in which it is enclosed. Without this assistance the aurelia would never be able to get free, as M. de Geer often found, who tried the experiment, by leaving the aurelia to themselves. The old ones not only assist them, but know the very precise time for lending their assistance; for, if produced too soon, the young one dies of cold; if retarded too long, it is suffocated in its prison.

When the female has done laying, and the whole brood is thus produced, her labours, as well as that of the male, become unnecessary; and her wings, which she had but a short time before so actively employed, drop off. What becomes of her when

thus divested of her ornaments is not well known, for she is seen in the cells for some weeks after. The males, on the other hand, having no longer any occupation at home, make use of those wings with which they have been furnished by nature, and fly away, never to return, or to be heard of more. It is probable they perish with the cold, or are devoured by the birds, which are particularly fond of this petty prey.

In the mean time, the working ants having probably deposed their queens, and being deserted by the males, that served but to clog the community, prepare for the severity of the winter, and bury their retreats as deep in the earth as they conveniently can. It is now found that the grains of corn, and other substances with which they furnish their hill, are only meant as fences to keep off the rigours of the weather, not as provisions to support them during its continuance. It is found generally to obtain, that every insect that lives a year after it is come to its full growth, is obliged to pass four or five months without taking any nourishment, and will seem to be dead all that time. It would be to no purpose, therefore, for ants to lay up corn for the winter, since they lie that time without motion, heaped upon each other, and are so far from eating, that they are utterly unable to stir. Thus what authors have dignified by the name of a magazine, appears to be no more than a cavity, which serves for a common retreat when the weather forces them to return to their lethargic state.

What has been said with exaggeration of the European ant, is however true, if asserted of those of the tropical climates. They build an ant-hill with

great contrivance and regularity, they lay up provisions, and, as they probably live the whole year, they submit themselves to regulations entirely unknown among the ants of Europe.

Those of Africa are of three kinds, the red, the green, and the black; the latter are above an inch long, and in every respect a most formidable insect. Their sting produces extreme pain, and their depredations are sometimes extremely destructive. They build an ant-hill of a very great size, from six to twelve feet high; it is made of viscous clay, and tapers into a pyramidal form. This habitation is constructed with great artifice; and the cells are so numerous and even, that an honeycomb scarce exceeds them in number and regularity.

The inhabitants of this edifice seem to be under a very strict regulation. At the slightest warning they will sally out upon whatever disturbs them; and if they have time to arrest their enemy, he is sure to find no mercy. Sheep, hens, and even rats are often destroyed by these merciless insects, and their flesh devoured to the bone. No anatomist in the world can strip a skeleton so completely as they; and no animal, how strong soever, when they have once seized upon it, has power to resist them.

It often happens that these insects quit their retreat in a body, and go in quest of adventures. "During my stay," says Smith, "at Cape Corse "Castle, a body of these ants came to pay us a visit "in our fortification. It was about day-break "when the advanced guard of this famished crew "entered the chapel, where some negroe servants "were asleep upon the floor. The men were "quickly alarmed at the invasion of this unexpected

" army, and prepared, as well as they could, for a " defence. While the foremost battalion of insects " had already taken possession of the place, the rear-" guard was more than a quarter of a mile distant. " The whole ground seemed alive, and crawling " with unceasing destruction. After deliberating " a few moments upon what was to be done, it was " resolved to lay a large train of gunpowder along " the path they had taken: by this means millions " were blown to pieces, and the rear-guard perceiv-" ing the destruction of their leaders, thought proper " instantly to return, and make back to their original " habitation."

The order which these ants observe, seems very extraordinary; whenever they sally forth, fifty or sixty larger than the rest are seen to head the band, and conduct them to their destined prey. If they have a fixed spot where their prey continues to resort, they then form a vaulted gallery, which is sometimes a quarter of a mile in length; and yet they will hollow it out in the space of ten or twelve hours.

[The green ants in New South Wales live in trees, where they construct nests, by bending down the large leaves, and glueing the points together, so as to form a kind of purse. To effect this, thousands unite their collected strength to bend the leaf into its proper form; while others apply a viscid animal matter, to keep the parts in contact fast together.

But far exceeding in wisdom and policy the Bee, the Ant, or the Beaver, is the white ant inhabiting the plains of East India, Africa, and South America. The animals of this extraordinary community consist of working insects or labourers, fighting in-

sects or soldiers, and the perfect male and female insect which alone are furnished with wings. They build pyramidal structures, ten or twelve feet in height, and divided into appropriate apartments, magazines for provisions, arched chambers, and galleries of communication. These are so firmly cemented together, that they will easily bear the weight of four or five men to stand upon them; and in the vast plains of Senegal, they appear like the huts of the natives.

The labourers are hardly half an inch long, have six feet, and no eyes. These are the most numerous, and to them is appointed the care of building the structures, procuring and laying up provisions for the males and females, and taking care of the eggs.

The soldiers are about as large again, with a very large head and no eyes. These never work, but act as superintendants over the labourers, or as guards to defend their habitation from intrusion and violence. If by any accident a breach be made in the dwelling, they rush forward and defend the entrance with great ferocity; some of them beating with their horny jaws against any hard substance, as a signal to the other guards, or as encouragement to the labourers; they then retire and are succeeded by the labourers, each having a burthen of tempered mortar in his mouth, and who diligently sets about to repair whatever injury may have been sustained. One of these guards attends every six or eight hundred labourers who are building a wall, taking no active part himself, but frequently making the noise above mentioned, which is constantly answered by a loud and distinct hiss from all the labourers, who

at this signal are observed evidently to redouble their diligence.

The male and female are alike furnished with four long horizontal wings, and after being extricated from their confinement in the crysalis state, fly abroad in the night; but soon after sun-rise, the wings become dry and they fall to the ground, where they are devoured by birds or sought after by the inhabitants who roast and eat them with great avidity. A few that survive are collected by the labourers and inclosed by pairs in apartments made of clay, the aperture of which is nearly closed up so that they cannot escape, and where they are diligently attended and fed by the labourers whose bodies are small enough to admit an easy entrance. After impregnation, the abdomen of the female grows to a prodigious bulk, exceeding the rest of her body nearly two thousand times: it is then vesicular and white with transverse brown spots and an undulate or slightly lobed margin. In this state it contains an immense number of eggs, which are protruded to the amount of eight thousand in twenty four hours. These eggs are instantly taken up by the labourers, and conveyed to separate chambers, where they are hatched, and the young attended and provided for till they are able to shift for themselves and take their share in the labours of the community.

With such wonderful dexterity and rapidity do these animals destroy food, furniture, books, clothes, and timber of whatever magnitude, leaving a mere surface not thicker than writing paper, that in a few hours, a large beam will be eaten to a shell.

To this tribe belongs a small insect, hardly the tenth of an inch long, and commonly found in old wood, decayed furniture, and neglected books and museums. It frequently makes a ticking kind of noise, not unlike the beating of a watch, and is often called the death-watch. But the insect which causes such alarm and palpitation to its supersti-tious terrified hearer, is a little animal of the beetle kind, found in decayed trees and furniture, among hay and dried leaves, and in collections of preserved plants. The noise they make resembles the ticking of a watch, and is always in seven, nine, or eleven distinct strokes. This noise is merely the call of one sex to the other, and arises from the animals beating on any hard substance with the shield or fore part of the head.]

CHAP. VI.

Of the Beetle, and its Varieties.

HITHERTO we have been treating of insects with four transparent wings, we now come to a tribe with two transparent wings, with cases that cover them close while at rest, but which allow them their proper play when flying. The principal of these are the Beetle, the May-Bug, and the Cantharis. These are all bred like the rest of their order, first from eggs, then they become grubs, then a chrysalis in which the parts of the future fly are distinctly seen, and lastly the animal leaves its pri-

son, breaking forth as a winged animal in full maturity.

Of the Beetle there are various kinds; all, however, concurring in one common formation of having cases to their wings, which are the more necessary to those insects, as they often live under the surface of the earth, in holes which they dig out by their own industry. These cases prevent the various injuries their real wings might sustain, by rubbing or crushing against the sides of their abode. These, though they do not assist flight, yet keep the internal wings clean and even, and produce a loud buzzing noise, when the animal rises in the air.

If we examine the formation of all animals of the beetle kind, we shall find, as in shell-fish, that their bones are placed externally, and their muscles within. These muscles are formed very much like those of quadrupeds, and are endued with such surprising strength, that bulk for bulk, they are a thousand times stronger than those of a man. The strength of these muscles is of use in digging the animal's subterraneous abode, where it is most usually hatched, and to which it most frequently returns, even after it becomes a winged insect, capable of flying.

Beside the difference which results from the shape and colour of these animals, the size also makes a considerable one; some beetles being not larger than the head of a pin, while others, such as the elephant-beetle, are as big as one's fist. But the greatest difference among them is, that some are produced in a month, and in a single season go through all the stages of their existence, while others take near four years to their production; and live

as winged insects a year more. To give the history of all these animals, that are bred pretty much in the same way, would be insipid and endless; it will suffice to select one or two from the number, the origin of which may serve as specimens of the rest. I will, therefore, offer the history of the May-bug to the reader's attention; premising, that most other beetles, though not so long lived, are bred in the same manner.

The May-bug or dorr-beetle, as some call it, has, like all the rest, a pair of cases to its wings, which are of a reddish brown colour, sprinkled with a whitish dust, which easily comes off. In some years their necks are seen covered with a red plate, and in others, with a black; these, however, are distinct sorts, and their difference is by no means accidental. The fore legs are very short, and the better calculated for burrowing in the ground, where this insect makes its retreat. It is well known for its evening buzz to children; but still more formidably introduced to the acquaintance of husbandmen and gardeners, for in some seasons it has been found to swarm in such numbers, as to eat up every vegetable production.

The two sexes in the May-bug are easily distinguished from each other, by the superior length of the tusts, at the end of the horns, in the male. They begin to copulate in summer, and at that season are seen joined together for a considerable time. The female being impregnated, quickly falls to boring an hole into the ground, where to deposit her burthen. This is generally about half a foot deep, and in it she places her eggs, which are of an oblong shape, with great regularity, one by the other. They

are of a bright yellow colour, and no way wrapped up in a common covering, as some have imagined. When the female is lightened of her burthen, she again ascends from her hole, to live as before, upon leaves and vegetables, to buzz in the summer evening, and to lie hid, among the branches of trees, in the heat of the day.

In about three months after these eggs have been thus deposited in the earth, the contained insect begins to break its shell, and a small grub or maggot crawls forth, and feeds upon the roots of whatever vegetable it happens to be nearest. All substances, of this kind, seem equally grateful, yet it is probable the mother insect has a choice among what kind of vegetables she shall deposit her young. In this manner these voracious creatures continue in the worm state, for more than three years, devouring the roots of every plant they approach, and making their way under ground, in quest of food, with great dispatch and facility. At length they grow to above the size of a walnut, being a great thick white maggot with a red head, which is seen most frequently in new-turned earth, and which is so eagerly sought after by birds of every species. When largest, they are found an inch and a half long, of a whitish yellow colour, with a body consisting of twelve segments or joints, on each side of which there are nine breathing holes, and three red feet. The head is large, in proportion to the body, of a reddish colour, with a pincer before, and a semi-circular lip, with which it cuts the roots of plants, and sucks out their moisture. As this insect lives entirely under ground, it has no occasion for eyes, and accordingly it is found to have none; but is furnished with

two feelers, which, like the crutch of a blind man, serve to direct its motions. Such is the form of this animal, that lives for years in the worm state under ground, still voracious, and every year changing its skin.

It is not till the end of the fourth year, that this extraordinary insect prepares to emerge from its subterraneous abode, and even this is not effected but by a tedious preparation. About the latter end of autumn, the grub begins to perceive the approach of its transformation, it then buries itself deeper and deeper in the earth, sometimes six feet beneath the surface, and there forms itself a capacious apartment, the walls of which it renders very smooth and shining, by the excretions of its body. Its abode being thus formed, it begins soon after to shorten itself, to swell, and to burst its last skin, in order to assume the form of a chrysalis. This, in the beginning, appears of a yellowish colour, which heightens by degrees, till at last it is seen nearly red. Its exterior form plainly discovers all the vestiges of the future winged insect, all the fore parts being distinctly seen; while behind, the animal seems as if wrapped in swaddling-cloaths.

The young May-bug continues in this state for about three months longer, and it is not till the beginning of January that the aurelia divests itself of all its impediments, and becomes a winged insect, completely formed. Yet still the animal is far from attaining its natural strength, health, and appetite. It undergoes a kind of infant imbecility; and, unlike most other insects, that the instant they become flies are arrived at their state of full perfection, the May-bug continues feeble and sickly. Its colour

is much brighter than in the perfect animal, all parts are soft, and its voracious nature seems for a while to have entirely forsaken it. As the animal is very often found in this state, it is supposed, by those unacquainted with its real history, that the old ones, of the former season, have buried themselves for the winter, in order to revisit the sun the ensuing summer. But the fact is, the old one never survives the season, but dies, like all the other winged tribe of insects, from the severity of cold in winter.

About the latter end of May, these insects, after having lived for four years under ground, burst from the earth, when the first mild evening invites them abroad. They are at that time seen rising from their long imprisonment, from living only upon roots, and imbibing only the moisture of the earth, to visit the mildness of the summer air, to chuse the sweetest vegetables for their banquet, and to drink the dew of the evening. Wherever an attentive observer then walks abroad, he will see them bursting up, before him in his pathway, like ghosts on a theatre. He will see every part of the earth, that had its surface beaten into hardness, perforated by their egression. When the season is favourable for them, they are seen by myriads buzzing along, hitting against every object that intercepts their flight. The mid-day sun, however, seems too powerful for their constitutions; they then lurk under the leaves and branches of some shady tree; but the willow seems particularly their most favourite food; there they lurk in clusters, and seldom quit the tree till they have devoured all its verdure. In those seasons which are favourable to their propagation they are

seen in an evening as thick as flakes of snow, and hitting against every object with a sort of capricious blindness. Their duration, however, is but short, as they never survive the season. They begin to join shortly after they have been let loose from their prison, and when the female is impregnated, she cautiously bores an hole in the ground, with an instrument fitted for that purpose, which she is furnished with at the tail, and there deposits her eggs, generally to the number of threescore. If the season and the soil be adapted to their propagation, these soon multiply as already described, and go through the noxious stages of their contemptible existence. This insect, however, in its worm state, though prejudicial to man, makes one of the chief repasts of the feathered tribe, and is generally the first nourishment with which they supply their young. Rooks and hogs are particularly fond of these worms, and devour them in great numbers. The inhabitants of the county of Norfolk, some time since, went into the practice of destroying their rookeries, but in proportion as they destroyed one plague, they were pestered with a greater; and these insects multiplied in such an amazing abundance, as to destroy not only the verdure of the fields, but even the roots of vegetables, not yet shot forth. One farm in particular was so injured by them in the year 1751, that the occupier was not able to pay his rent; and the landlord was not only content to lose his income for that year, but also gave money for the support of the farmer and his family. In Ireland they suffered so much by these insects, that they came to a resolution of setting fire to a wood, of some miles in extent, to prevent their mischievous propagation.

Of all the beetle kind this is the most numerous, and therefore deserves the chief attention of history. The numerous varieties of other kinds might repay the curiosity of the diligent observer, but we must be content in general to observe, that in the great out-lines of the history, they resemble those of which we have just been giving a description; like them, all other beetles are bred from the egg, which is deposited in the ground, or sometimes, though seldom, in the barks of trees, they change into a worm; they subsist in that state by living upon the roots of vegetables, or the succulent parts of the bark round them. They generally live a year at least before they change into an aurelia; in that state they are not entirely motionless, nor entirely swaddled up without form.

It would be tedious and endless to give a description of all, and yet it would be an unpardonable omission not to mention the particularities of some beetles, which are singular rather from their size, their manners, or their formation. That beetle which the Americans call the Tumble-dung, particularly demands our attention; it is all over of a dusky black, rounder than those animals are generally found to be, and so strong, though not much larger than the common black beetle, that if one of them be put under a brass candlestick, it will cause it to move backwards and forwards, as if it were by an invisible hand, to the admiration of those who are not accustomed to the sight; but this strength is given it for much more useful purposes than those of exciting human curiosity, for there is no creature more laborious, either in seeking subsistence, or in providing a proper retreat for its young. They are

endowed with sagacity to discover subsistence by their excellent smelling, which directs them in flights to excrements just fallen from man or beast, on which they instantly drop, and fall unanimously to work in forming round balls or pellets thereof, in the middle of which they lay an egg. These pellets, in September, they convey three feet deep in the earth, where they lie till the approach of spring, when the eggs are hatched, the nests burst, and the insects find their way out of the earth. They assist each other with indefatigable industry, in rolling these globular pellets to the place where they are to be buried. This they are to perform with the tail foremost, by raising up their hinder part, and shoving along the ball with their hind feet. They are always accompanied with other beetles of a larger size, and of a more elegant structure and colour. The breast of this is covered with a shield of a crimson colour, and shining-like metal; the head is of the like colour, mixed with green, and on the crown of the head stands a shining black horn, bended backwards. These are called the kings of the beetles, but for what reason is uncertain, since they partake of the same dirty drudgery with the rest.*

The Elephant-Beetle is the largest of this kind hitherto known, and is found in South America, particularly Guiana and Surinam, as well as about the river Oroonoko. It is of a black colour, and the whole body is covered with a very hard shell,

[* The crepitating Beetle has a very singular method of defending itself, and annoying its enemies. Whenever it is touched it makes a report, not unlike the discharge of a musket in miniature; and this discharge is accompanied with a blue vapour highly acrimonious and pungent. This vapour is contained in a bladder, seated near the end of the abdomen. It is found concealed among stones, and moves itself by a kind of jump.]

full as thick and as strong as that of a small crab. Its length, from the hinder part to the eyes, is almost four inches, and from the same part to the end of the proboscis, or trunk, four inches and three quarters. The transverse diameter of the body is two inches and a quarter, and the breadth of each elytron, or case for the wings, is an inch and three tenths. The antennæ or feelers, are quite horny; for which reason the proboscis or trunk is moveable at its insertion into the head, and seems to supply the place of feelers. The horns are eight tenths of an inch long, and terminate in points. The proboscis is an inch and a quarter long, and turns upwards, making a crooked line, terminating in two horns, each of which is near a quarter of an inch long; but they are not perforated at the end like the proboscis of other insects. About four tenths of an inch above the head, or that side next the body, is a prominence, or small horn, which if the rest of the trunk were away, would cause this part to resemble the horn of a rhinoceros. There is indeed a beetle so called, but then the horns or trunk has no fork at the end, though the lower horn resembles this. The feet are all forked at the end, but not like lobsters claws.

To this class we may also refer the Glow-worm, that little animal which makes such a distinguished figure in the descriptions of our poets. No two insects can differ more than the male and female of this species from each other. The male is in every respect a beetle, having cases to its wings, and rising in the air at pleasure; the female, on the contrary, has none, but is entirely a creeping insect, and is obliged to wait the approaches of her capricious companion. The body of the female has eleven

joints, with a shield breast-plate, the shape of which is oval; the head is placed over this, and is very small, and the three last joints of her body are of a yellowish colour; but what distinguishes it from all other animals, at least in this part of the world, is the shining light which it emits by night, and which is supposed by some philosophers, to be an emanation which she sends forth to allure the male to her company. Most travellers who have gone through sandy countries must well remember the little shining sparks with which the ditches are studded on each side of the road. If incited by curiosity to approach more nearly, he will find the light sent forth by the glow-worm; if he should keep the little animal for some time, its light continues to grow paler, and at last appears totally extinct. The manner in which this light is produced has hitherto continued inexplicable; it is probable the little animal is supplied with some electrical powers, so that by rubbing the joints of its body against each other it thus supplies a stream of light which if it allures the male, as we are told, serves for very useful purposes.

The Cantharis is of the beetle kind, from whence come cantharides, well known in the shops by the name of Spanish flies, and for their use in blisters. They have feelers like bristles, flexible cases to the wings, a breast pretty plain, and the sides of the belly wrinkled. Cantharides differ from each other in their size, shape, and colour, those used in the shops also do the same. The largest in these parts are about an inch long, and as much in circumference, but others are not above three quarters of an inch. Some are of a pure azure colour, others of

pure gold, and others again have a mixture of pure gold, and azure colours: but they are all very brilliant, and extremely beautiful. These insects, as is well known, are of the greatest benefit to mankind, making a part in many medicines conducive to human preservation. They are chiefly natives of Spain, Italy, and Portugal; but they are to be met with also about Paris in the summer time, upon the leaves of the ash, the poplar, and the rose-trees, and also among wheat, and in meadows. It is very certain that these insects are fond of ash-leaves, insomuch that they will sometimes strip one of these trees quite bare. Some affirm, that these flies delight in sweet-smelling herbs, and it is very certain, that they are fond of honey-suckles, lilac, and wild-cherry shrubs; but some that have sought after them declare, they never could find them on elder-trees, nut-trees, and among wheat. We are told that the country people expect the return of these insects every seven years. It is very certain, that such a number of these insects have been seen together in the air, that they appeared like swarms of bees; and that they have so disagreeable a smell, that it may be perceived a great way off, especially about sunset, though they are not seen at that time. This bad smell is a guide for those who make it their business to catch them. When they are caught they dry them, after which they are so light, that fifty will hardly weigh a dram. Those that gather them, tie them in a bag, or a piece of linen cloth, that has been well worn, and then they kill them with the vapours of hot vinegar, after which they dry them in the sun, and keep them in boxes. These flies, thus dried, being chymically analysed, yield a great deal of volatile caustic salt, mixed with a little oil, phlegm,

and earth. Cantharides are penetrating, corrosive, and, applied to the skin, raise blisters, from whence proceeds a great deal of serosity. They are made use of both inwardly and outwardly. However it is somewhat strange that the effects of these flies should fall principally upon the urinary passages; for though some authors have endeavoured to account for this, we are still in the dark, for all they have said amounts to no more, than that they affect these parts in a manner which may be very learnedly described, but very obscurely comprehended.

An insect of great, though perhaps not equal use in medicine, is that which is known by the name of the Kermes; it is produced in the excrescence of an oak, called the berry-bearing ilex, and appears at first wrapt up in a membranaceous bladder, of the size of a pea, smooth and shining, of a brownish red colour, and covered with a very fine ash-coloured powder. This bag teems with a number of reddish eggs or insects, which being rubbed with the fingers, pour out a crimson liquor. It is only met with in warm countries in the months of May and June. In the month of April this insect becomes of the size and shape of a pea, and its eggs some time after burst from the womb, and soon turning worms, run about the branches and leaves of the tree. They are of two sexes, and the females have been hitherto described; but the males are very distinct from the former, and are a sort of small flies like gnats, with six feet, of which the four forward are short, and the two backward long, divided into four joints, and armed with three crooked nails. There are two feelers on the head a line and a half long, which are moveable, streaked and articulated. The tail, at

the back part of the body, is half a line long, and forked. The whole body is covered with two transparent wings, and they leap about in the manner of fleas. The harvest of the kermes is greater or less in proportion to the severity of the winter; and the women gather them before sun-rising, tearing them off with their nails, for fear there should be any loss from the hatching of the insects. They sprinkle them with vinegar, and lay them in the sun to dry, where they acquire a red colour.

An insect, perhaps, still more useful than either of the former, is the Cochineal, which has been variously described by authors; some have supposed it a vegetable excrescence from the tree upon which it is found; some have described it as a louse, some as a bug, and some as a beetle. As they appear in our shops when brought from America, they are of an irregular shape, convex on one side, and a little concave on the other; but are both marked with transverse streaks or wrinkles. They are of a scarlet colour within, and without of a blackish red, and sometimes of a white, reddish, or ash-colour, which are accounted the best, and are brought to us from Mexico. The cochineal insect is of an oval form, of the size of a small pea, with six feet, and a snout or trunk. It brings forth its young alive, and is nourished by sucking the juice of the plant. Its body consists of several rings, and when it is once fixed on the plant, it continues immoveable, being subject to no change. Some pretend there are two sorts, the one domestic, which is best, and the other wild, that is of a vivid colour; however, they appear to be the same, only with this difference, that the wild feeds upon uncultivated trees, without any as-

sistance, whereas the domestic is carefully, at a stated season, removed to cultivated trees, where it feeds upon a purer juice. Those who take care of these insects, place them on the prickly pear-plant in a certain order, and are very industrious in defending them from other insects; for if any other kind come among them, they take care to brush them off with foxes tails. Towards the end of the year, when the rains and cold weather are coming on, which are fatal to these insects, they take off the leaves or branches covered with cochineal, that have not attained their utmost degree of perfection, and keep them in their houses till winter is past. These leaves are very thick and juicy, and supply them with sufficient nourishment, while they remain within doors. When the milder weather returns, and these animals are about to exclude their young, the natives make them nests, like those of birds, but less, of tree-moss, or soft hay, or the down of cocoa-nuts, placing twelve in every nest. These they fix on the thorns of the prickly pear-plant, and in three or four days time they bring forth their young, which leave their nests in a few days, and creep upon the branches of the plant, till they find a proper place to rest in, and take in their nourishment; and until the females are fecundated by the males, which, as in the former tribe, differ very widely, from the females being winged insects, whereas the others only creep, and are at most stationary. When they are impregnated, they produce a new offspring, so that the propagator has a new harvest thrice a year. When the native Americans have gathered the cochineal, they put them into holes in the ground, where they kill them with boiling water, and after-

wards dry them in the sun, or in an oven, or lay them upon hot plates. From the various methods of killing them, arise the different colours which they appear in when brought to us. While they are living, they seem to be sprinkled over with a white powder, which they lose as soon as the boiling water is poured upon them. Those that are dried upon hot plates are the blackest. What we call the cochineal are only the females, for the males are a sort of fly, as already observed in the kermes. They are used both for dying and medicine, and are said to have much the same virtue as the kermes, though they are now seldom used alone, but are mixed with other things for the sake of the colour.

I shall end this account of the beetle tribe with the history of an animal which cannot properly be ranked under this species, and yet which cannot be more methodically ranged under any other. This is the insect that forms and resides in the gall-nut, the spoils of which are converted to such useful purposes, The Gall Insects are bred in a sort of bodies adhering to a kind of oak in Asia, which differ with regard to their colour, size, roughness, smoothness and shape, and which we call galls. They are not fruit, as some have imagined, but preternatural tumours, owing to the wounds given to the buds, leaves, and twigs of the tree, by a kind of insects that lay their eggs within them. This animal is furnished with an implement, by which the female penetrates into the bark of the tree, or into that spot which just begins to bud, and there sheds a drop of corrosive fluid into the cavity. Having thus formed a receptacle for her eggs, she deposits them in the place, and dies soon after. The heart of the bud being thus wounded,

the circulation of the nutritive juice is interrupted, and the fermentation thereof, with the poison injected by the fly, burns the parts adjacent, and then alters the natural colour of the plant. The juice or sap, turned back from its natural course, extravasates and flows round the egg; after which it swells and dilates by the assistance of some bubbles of air, which get admission through the pores of the bark, and which run in the vessels with the sap. The external coat of this excrescence is dried by the air, and grows into a figure which bears some resemblance to the bow of an arch, or the roundness of a kernel. This little ball receives its nutriment, growth, and vegetation, as the other parts of the tree, by slow degrees, and is what we call the gall-nut. The worm that is hatched under this spacious vault, finds in the substance of the ball, which is as yet very tender, a subsistence suitable to its nature; gnaws and digests it till the time comes for its transformation to a nymph, and from that state of existence changes into a fly. After this the insect, perceiving itself duly provided with all things requisite, disengages itself soon from its confinement, and takes its flight into the open air. The case, however, is not similar with respect to the gall-nut that grows in autumn. The cold weather frequently comes on before the worm is transformed into a fly, or before the fly can pierce through its inclosure. The nut falls with the leaves, and although you may imagine that the fly which lies within is lost, yet in reality it is not so; on the contrary, its being covered up so close is the means of its preservation. Thus it spends the winter in a warm house, where every crack and cranny of the nut is well stopped up; and

lies buried as it were under a heap of leaves, which preserves it from the injuries of the weather. This apartment, however, though so commodious a retreat in the winter, is a perfect prison in the spring. The fly, roused out of its lethargy by the first heats, breaks its way through, and ranges where it pleases. A very small aperture is sufficient, since at this time the fly is but a diminutive creature. Besides, the ringlets whereof its body is composed, dilate, and become pliant in the passage.

CHAP. VII.

Of the Gnat and Tipula.

THERE are two insects which entirely resemble each other in their form, and yet widely differ in their habits, manners, and propagation. Those who have seen the Tipula, or Long-legs, and the larger kind of Gnat, have most probably mistaken the one for the other; they have often accused the tipula, a harmless insect, of depredations made by the gnat, and the innocent have suffered for the guilty; indeed the differences in their form are so very minute, that it often requires the assistance of a microscope to distinguish the one from the other: they are both mounted on long legs, both furnished with two wings and a slender body; their heads are large, and they seem to be hump-backed; the chief and only difference, therefore, is, that the tipula wants a

trunk, while the gnat has a large one, which it often exerts to very mischievous purposes. The tipula is a harmless, peaceful insect, that offers injury to nothing; the gnat is sanguinary and predaceous, ever seeking out for a place in which to bury its trunk, and pumping up the blood from the animal in large quantities.

The gnat proceeds from a little worm, which is usually seen at the bottom of standing waters. The manner in which the insect lays its eggs is particularly curious; after having laid the proper number on the surface of the water, it surrounds them with a kind of unctuous matter, which prevents them from sinking; but at the same time fastens them with a thread to the bottom, to prevent their floating away, at the mercy of every breeze, from a place the warmth of which is proper for their production, to any other, where the water may be too cold, or the animal's enemies too numerous. Thus the insects, in their egg state, resemble a buoy, which is fixed by an anchor. As they come to maturity they sink deeper, and at last, when they leave the egg as worms, they creep at the bottom. They now make themselves lodgments of cement, which they fasten to some solid body at the very bottom of the water, unless, by accident, they meet with a piece of chalk, which being of a soft and pliant nature, gives them an opportunity of sinking a retreat for themselves, where nothing but the claws of a cray-fish can possibly molest them. The worm afterwards changes its form. It appears with a large head, and a tail invested with hair, and moistened with an oleaginous liquor, which she makes use of as a cork, to sustain her head in the air, and her tail in the water, and to

transport her from one place to another. When the oil with which her tail is moistened begins to grow dry, she discharges out of her mouth an unctuous humour, which she sheds all over her tail, by virtue whereof she is enabled to transport herself where she pleases, without being either wet or any ways incommoded by the water. The gnat in her second state is, properly speaking, in her form of a nymph, which is an introduction or entrance into a new life. In the first place, she divests herself of her second skin; in the next she resigns her eyes, her antennæ, and her tail; in short, she actually seems to expire. However, from the spoils of the amphibious animal, a little winged insect cuts the air, whose every part is active to the last degree, and whose whole structure is the just object of our admiration. Its little head is adorned with a plume of feathers, and its whole body invested with scales and hair, to secure it from any wet or dust. She makes trial of the activity of her wings, by rubbing them either against her body, or her broad side-bags, which keep her in an equilibrium. The furbelow, or little border of fine feathers, which graces her wings, is very curious, and strikes the eye in the most agreeable manner. There is nothing, however, of greater importance to the gnat than her trunk, and that weak implement may justly be deemed one of nature's master-pieces. It is so very small, that the extremity of it can scarcely be discerned through the best microscope that can be procured. That part which is at first obvious to the eye, is nothing but a long scaly sheath under the throat. At near the distance of two thirds of it there is an aperture, through which the insect darts out four stings, and afterwards re-

tracts them. One of which, however sharp and active it may be, is no more than the case in which the other three lie concealed, and run in a long groove. The sides of these stings are sharpened like two-edged swords; they are likewise barbed, and have a vast number of cutting teeth towards the point, which turns up like a hook, and is fine beyond expression. When all these darts are stuck into the flesh of animals, sometimes one after another, and sometimes all at once, the blood and humours of the adjacent parts must unavoidably be extravasated; upon which a tumour must consequently ensue, the little orifice whereof is closed up by the compression of the external air. When the gnat, by the point of her case, which she makes use of as a tongue, has tasted any fruit, flesh, or juice, that she has found out; if it be a fluid, she sucks it up, without playing her darts into it; but in case she finds the least obstruction by any flesh whatever, she exerts her strength, and pierces through it, if possibly she can. After this she draws back her stings into their sheath, which she applies to the wound in order to extract, as through a reed, the juices which she finds inclosed. This is the implement with which the gnat performs her work in the summer, for during the winter she has no manner of occasion for it. Then she ceases to eat, and spends all that tedious season either in quarries or in caverns, which she abandons at the return of summer, and flies about in search after some commodious ford, or standing water, where she may produce her progeny, which would be soon washed away and lost, by the too rapid motion of any running stream. The little brood are sometimes so numerous, that the very

water is tinged according to the colour of the species, as green, if they be green, and of a sanguine hue, if they be read.

These are circumstances sufficiently extraordinary in the life of this little animal; but it offers something still more curious in the method of its propagation. However similar insects of the gnat kind are in their appearance, yet they differ widely from each other in the manner in which they are brought forth, for some are oviparous, and are produced from eggs; some are viviparous, and come forth in their most perfect form; some are males, and unite with the female; some are females, requiring the impregnation of the male; some are of neither sex, yet still produce young, without any copulation whatsoever. This is one of the strangest discoveries in all natural history! A gnat separated from the rest of its kind, and inclosed in a glass vessel, with air sufficient to keep it alive, shall produce young, which also, when separated from each other, shall be the parents of a numerous progeny. Thus, down for five or six generations, do these extraordinary animals propagate without the use of copulation, without any congress between the male and female, but in the manner of vegetables, the young bursting from the body of their parents, without any previous impregnation. At the sixth generation, however, their propagation stops, the gnat no longer produces its like, from itself alone, but it requires the access of the male to give it another succession of fecundity.

The gnat of Europe gives but little uneasiness; it is sometimes heard to hum about our beds at night, and keeps off the approaches of sleep by the apprehension it causes; but it is very different in the ill-

peopled regions of America, where the waters stagnate, and the climate is warm, and where they are produced in multitudes beyond expression. The whole air is there filled with clouds of those famished insects; and they are found of all sizes, from six inches long, to a minuteness that even requires the microscope to have a distinct perception of them. The warmth of the mid-day sun is too powerful for their constitutions; but when the evening approaches, neither art nor flight can shield the wretched inhabitants from their attacks; though millions are destroyed, still millions more succeed, and produce unceasing torment. The native Indians, who anoint their bodies with oil, and who have from their infancy been used to their depredations, find them much less inconvenient than those who are newly arrived from Europe; they sleep in their cottages covered all over with thousands of the gnat kind upon their bodies, and yet do not seem to have slumbers interrupted by their cruel devourers. If a candle happens to be lighted in one of those places, a cloud of insects at once light upon the flame, and extinguish it; they are therefore obliged to keep their candles in glass lanthorns; a miserable expedient to prevent an unceasing calamity!

[CHAP. VIII.]

Of the Gad-fly.

THE Gad-fly, or Breeze, is an insect well known to husbandmen, from its annoyance in the summer

to cattle. These troublesome animals deposit their eggs either under the skin on some part of the body, or place them where they can be conveniently licked off, and so conveyed into the stomach, or snuffed up the nostrils. The face of this singular tribe is broad and flat, and has some resemblance to the Ape kind: and at the tail they are furnished with a curious sort of gimlet, composed of four tubes which draw out like the joints of an opera-glass, the last armed with three hooks, and it is with this instrument they pierce the hides of horned cattle. The principal of these are the Ox Gad-fly, the Horse Gad-fly, the Sheep Gad-fly, and the Reindeer Gad-fly already described.

The Ox Gad-fly deposits its eggs under the skin on the back of cattle, where the grub feeds on the matter issuing from the wound. By the pain it inflicts, an extreme terror and agitation is produced, and the object of the attack runs bellowing about, with its tail erect, and in a tremulous kind of motion, which agitation is soon communicated to the whole herd, who race about the fields, and betake themselves to some pool of water for security against their mischievous enemy. The tumour produced by the grub, during its state of growth, is sometimes an inch high. Here remaining its destined time, it afterwards escapes from the sac, and falling on the ground becomes a crysalis.

The Horse Gad fly deposits its eggs on the hair of the horse, or on the lips, and always on those parts which are most liable to be licked by the tongue: these are conveyed into the stomach, when the grubs, known by the name of Bots, adhere to the coats of the stomach and intestines by means of small hooks, and

feed on the chyle there produced. When full grown, they gradually pass through the intestines with the food, and are discharged with the dung.

The Sheep Gad-fly lays its eggs on the inner margin of the nostrils of sheep, from whence it is conveyed into the frontal sinuses, and when full-grown discharged from the nostrils again. The moment one of these flies touches the nose of a sheep, it is observed to shake its head violently and stamp on the ground with its fore-feet, running about, and holding its nose to the earth, or burying it in sand or dust.

In South America, an insect of this kind deposits its eggs under the skin on the bellies of the natives, occasioning a troublesome tumour. The grub, if it be disturbed, will eat deeper and deeper, producing a bad ulcer, which without much care and attention will often become fatal.

A

HISTORY

OF THE

ZOOPHYTES.

PART V.

CHAP. I.

Of Zoophytes in General.

WE are now come to the last link in the chain of animated nature, to a class of beings so confined in their powers, and so defective in their formation, that some historians have been at a loss whether to consider them as a superior rank of vegetables, or the humblest order of the animated tribe. In order therefore to give them a denomination, agreeable to their existence, they have been called Zoophytes, a name implying vegetable nature endued with animal life; and, indeed, in some the marks of the animal are so few, that it is difficult to give their place in nature with precision, or to tell whether it is a plant or an insect that is the object of our consideration.

Should it be asked what it is that constitutes the difference between animal and vegetable life, what it is that lays the line that separates those two great kingdoms from each other, it would be difficult, perhaps we should find it impossible, to return an answer. The power of motion cannot form this distinction, since some vegetables are possessed of motion, and many animals are totally without it. The sensitive plant has obviously a greater variety of motions than the oyster or the pholas. The animal that fills the acorn-shell is immoveable, and can only close its lid to defend itself from external injury, while the flower, which goes by the name of the

fly-trap, seems to close upon the flies that light upon it, and that attempt to rifle it of its honey. The animal in this instance seems to have scarcely a power of self-defence; the vegetable not only guards its possessions, but seizes upon the robber that would venture to invade them. In like manner, the methods of propagation give no superiority to the lower rank of animals. On the contrary, vegetables are frequently produced more conformably to the higher ranks of the creation; and though some plants are produced by cuttings from others, yet the general manner of propagation is from seeds, laid in the womb of the earth, where they are hatched into the similitude of the parent plant or flower. But a most numerous tribe of animals have lately been discovered, which are propagated by cuttings, and this in so extraordinary a manner, that, though the original insect be divided into a thousand parts, each however small, shall be formed into an animal, entirely resembling that which was at first divided; in this respect, therefore, certain races of animals seem to fall beneath vegetables, by their more imperfect propagation.

What, therefore, is the distinction between them, or are the orders so intimately blended as that it is impossible to mark the boundaries of each? To me it would seem, that all animals are possessed of one power, of which vegetables are totally deficient; I mean either the actual ability, or an aukward attempt at self-preservation. However vegetables may seem possessed of this important quality, yet it is with them but a mechanical impulse, resembling the raising one end of the lever, when you depress the other: the sensitive plant contracts and hangs its

leaves, indeed, when touched, but this motion no way contributes to its safety; the fly-trap flower acts entirely in the same manner; and though it seems to seize the little animal that comes to annoy it, yet, in reality, only closes mechanically upon it, and this inclosure neither contributes to its preservation nor its defence. But it is very different with insects, even of the lowest order; the earth-worm not only contracts, but hides itself in the earth, and escapes with some share of swiftness from its pursuers. The polypus hides its horns; the star-fish contracts its arms, upon the appearance even of distant dangers; they not only hunt for their food, but provide for their safety, and however imperfectly they may be formed, yet still they are in reality placed many degrees above the highest vegetable of the earth, and are possessed of many animal functions, as well as those that are more elaborately formed.

But though these be superior to plants, they are far beneath their animated fellows of existence. In the class of zoophytes, we may place all those animals, which may be propagated by cuttings, or in other words, which, if divided into two or more parts, each part in time becomes a separate and perfect animal; the head shoots forth a tail, and on the contrary, the tail produces an head; some of these will bear dividing but into two parts, such is the earth-worm; some may be divided into more than two, and of this kind are many of the star-fish; others still may be cut into a thousand parts, each becoming a perfect animal; they may be turned inside out, like the finger of a glove, they may be moulded into all manner of shapes, yet still their vivacious principle remains, still every single part

becomes perfect in its kind, and after a few days existence, exhibits all the arts and industry of its contemptible parent! We shall, therefore, divide zoophytes according to their several degrees of perfection, namely, into Worms, Star-fish and Polypi; contenting ourselves with a short review of those nauseous and despicable creatures, that excite our curiosity chiefly by their imperfections; it must not be concealed, however, that much has of late been written on this part of natural history. A new mode of animal production, could not fail of exciting not only the curiosity, but the astonishment of every philosopher; many found their favourite systems totally overthrown by the discovery; and it was not without a wordy struggle, that they gave up what had formerly been their pleasure and their pride. At last, however, conviction became too strong for argument, and a question, which owed its general spread rather to its novelty, than to its importance, was given up in favour of the new discovery.

CHAP. II.

Of Worms.

THE first in the class of zoophytes, are animals of the Worm kind, which being entirely destitute of feet, trail themselves along upon the ground, and find themselves a retreat under the earth, or in the water. As these, like serpents, have a creeping mo-

tion, so both, in general, go under the common appellation of reptiles; a loathsome, noxious, malignant tribe, to which man by nature, as well as by religion, has the strongest antipathy. But though worms, as well as serpents, are mostly without feet, and have been doomed to creep along the earth on their bellies, yet their motions are very different. The serpent, as has been said before, having a back-bone which it is incapable of contracting, bends its body into the form of a bow, and then shoots forward from the tail; but it is very different with the worm, which has a power of contracting or lengthening itself at will. There is a spiral muscle, that runs round its whole body, from the head to the tail, somewhat resembling a wire wound round a walking-cane, which, when slipped off, and one end extended and held fast, will bring the other nearer to it; in this manner the earth-worm, having shot out, or extended its body, takes hold by the slime of the fore part of its body, and so contracts and brings forward the hinder part; in this manner it moves onward, not without great efforts, but the occasions for its progressive motion are few.

As it is designed for living under the earth, and leading a life of obscurity, so it seems tolerably adapted to its situation. Its body is armed with small stiff sharp burrs or prickles, which it can erect or depress at pleasure; under the skin there lies a slimy juice, to be ejected as occasion requires, at certain perforations, between the rings of the muscles, to lubricate its body, and facilitate its passage into the earth. Like most other insects, it hath breathing-holes along the back, adjoining each ring; but it is without bones, without eyes, without ears, and, pro-

perly without feet. It has a mouth, and also an alimentary canal, which runs along to the very point of the tail. In some worms, however, particularly such as are found in the bodies of animals, this canal opens towards the middle of the belly, at some distance from the tail. The intestines of the earthworm are always found filled with a very fine earth, which seems to be the only nourishment these animals are capable of receiving.

The animal is entirely without brain, but near the head is placed the heart, which is seen to beat with a very distinct motion, and round it are the spermatic vessels, forming a number of little globules, containing a milky fluid, which have an opening into the belly, not far from the head: they are also often found to contain a number of eggs, which are laid in the earth, and are hatched in twelve or fourteen days into life, by the genial warmth of their situation; like snails, all these animals unite in themselves both sexes at once, the reptile that impregnates, being impregnated in turn; few that walk out, but must have observed them with their heads laid against each other, and so strongly attached that they suffer themselves to be trod upon.

When the eggs are laid in the earth, which, in about fourteen days, as has been said, are hatched into maturity, the young ones come forth very small, but perfectly formed, and suffer no change during their existence: how long their life continues is not well known, but it certainly holds for more than two or three seasons. During the winter, they bury themselves deeper in the earth, and seem, in some measure, to share the general torpidity of the insect

tribe. In spring, they revive with the rest of nature, and on those occasions, a moist or dewy evening brings them forth from their retreats, for the universal purpose of continuing their kind. They chiefly live in a light rich and fertile soil, moistened by dews or accidental showers, but avoid those places where the water is apt to lie on the surface of the earth, or where the clay is too stiff for their easy progression under ground.

Helpless as they are formed, yet they seem very vigilant in avoiding those animals that chiefly make them their prey; in particular, the mole, who feeds entirely upon them beneath the surface, and who seldom ventures, from the dimness of its sight, into the open air; him they avoid, by darting up from the earth, the instant they feel the ground move: and fishermen, who are well acqainted with this, take them in what numbers they chuse, by stirring the earth where they expect to find them. They are also driven from their retreats under ground, by pouring bitter or acrid water thereon, such as that water in which green walnuts have been steeped, or a ley made of pot-ashes.

Such is the general outline of the history of these reptiles, which, as it should seem, degrades them no way beneath the rank of other animals of the insect creation; but now we come to a part of their history, which proves the imperfection of their organs, from the easiness with which these little machines may be damaged and repaired again. It is well known in mechanics, that the finest and most complicated instruments are the most easily put out of order, and the most difficultly set right; the same also obtains in the animal machine. Man, the most

complicated machine of all others, whose nerves are more numerous, and powers of action more various, is more easily destroyed: he is seen to die under wounds which a quadruped or a bird could easily survive; and as we descend gradually to the lower ranks, the ruder the composition, the more difficult it is to disarrange it. Some animals live without their limbs, and often are seen to reproduce them; some are seen to live without their brain for many weeks together; caterpillars continue to increase and grow large, though all their nobler organs are entirely destroyed within; some animals continue to exist, though cut in two, their nobler parts preserving life, while the others perish that were cut away; but the earth-worm, and all the zoophyte tribe, continue to live in separate parts, and one animal, by the means of cutting, is divided into two distinct existences, sometimes into a thousand.

There is no phænomenon in all natural history more astonishing than this, that man, at pleasure, should have a kind of creative power, and out of one life make two, each completely formed, with all its apparatus and functions, each with its perceptions, and powers of motion and self-preservation, each as complete in all respects as that from which it derived its existence, and equally enjoying the humble gratifications of its nature.

When Des Cartes first started the opinion, that brutes were machines, the discovery of this surprising propagation was unknown, which might, in some measure, have strengthened his fanciful theory. What is life, in brutes, he might have said, or where does it reside? In some we find it so diffused, that every part seems to maintain a vivacious principle,

and the same animal appears possessed of a thousand distinct irrational souls at the same time. But let us not, he would say, give so noble a name to such contemptible powers, but rank the vivifying principle in these with the sap that rises in vegetables, or the moisture that contracts a cord, or the heat that puts water into motion! Nothing, in fact, deserves the name of soul, but that which reasons, that which understands, and by knowing God, receives the mark of its currency, and is minted with the impression of its great Creator.

Such might have been the speculations of this philosopher: however, to leave theory, it will be sufficient to say that we owe the first discovery of this power of reproduction in animals to Mr. Trembley, who first observed it in the polypus; and after him, Spalanzani and others found it taking place in the earth-worm, the sea-worm, and several other ill-formed animals of a like kind, which were susceptible of this new mode of propagation. This last philosopher has tried several experiments upon the earth-worm, many of which succeeded according to his expectation; every earth-worm, however, did not retain the vivacious principle with the same obstinacy; some, when cut in two, were entirely destroyed; others survived only in the nobler part; and while the head was living the tail entirely perished, and a new one was seen to burgeon from the extremity. But what was most surprising of all, in some, particularly in the small red-headed earth-worm, both extremities survived the operation; the head produced a tail with the anus, the intestines, the annular muscle, and the prickly beards; the tail part, on the other hand, was seen to shoot forth the

nobler organs, and in less than the space of three months sent forth a head, a heart, with all the apparatus and instruments of generation. This part, as may easily be supposed, was produced much more slowly than the former, a new head taking above three or four months for its completion, a new tail being shot forth in less than as many weeks. Thus two animals, by dissection, were made out of one, each with their separate appetites, each endued with life and motion, and seemingly as perfect as that single animal from whence they derived their origin.

What was performed upon the earth-worm, was found to obtain also in many of the vermicular species. The sea-worm, the white water-worm, and many of those little worms with feelers, found at the bottom of dirty ditches; in all these the nobler organs are of such little use, that if taken away, the animal does not seem to feel the want of them; it lives in all its parts, and in every part, and by a strange paradox in nature, the most useless and contemptible life is of all others the most difficult to destroy.

[Allied to these in their vermicular shape, are several other kinds of worms, commonly known by the name of thread-worms. The common hair-worm is found in fresh waters or in a wet clayey soil, through which it perforates. In size and appearance it so exactly resembles the hair of a horse's tail, that among the uninformed classes of people, the opinion still prevails of its being a hair animated by having been dropped into the water. When touched, it twists itself into a variety of knot-like contortions, for which reason it has been called the

Gordius. It is of equal size throughout, and its bite is supposed to produce a whitlow.

The Guinea-worm is shaped something like this, except that the mouth is dilated and has a roundish concave lip. It enters the naked arms and legs of the inhabitants of the East and West Indies, sinking deep into the muscles, and frequently occasioning inflammation and fever. The only means by which it can be extracted, is to tie a piece of thread round its head and gradually drawing it away, taking the greatest care that the animal do not break; for if this happens, the part left behind will grow with redoubled vigour, and produce tormenting and often fatal consequences.

The Fury is a still more dangerous worm, and has on each side a single row of closely pressed reflected prickles. It is found in Finland and the northern parts of Sweden, in marshy places, where it crawls up the stems of sedge-grass and low shrubs; and being wafted by the wind, darts into the naked parts of such as may happen to be near it. It buries itself suddenly into the flesh, producing in a short time, gangrene, inflammation, and swooning; and if it be not extracted in two days, death is the inevitable consequence. The celebrated naturalist, Sir Charles Linné, was so severely bitten by one of these dreadful animals, that for some time it was doubtful whether he would live or die.]

CHAP. III.

Of the Star-fish.

THE next order of zoophytes is that of the Star-fish, a numerous tribe, shapeless and deformed, assuming at different times different appearances. The same animal that now appears round like a ball, shortly after flattens as thin as a plate. All of this kind are formed of a semi-transparent gelatinous substance, covered with a thin membrane, and, to an inattentive spectator, often appear like a lump of inanimate jelly, floating at random upon the surface of the sea, or thrown by chance on shore at the departure of the tide. But upon a more minute inspection, they will be found possessed of life and motion; they will be found to shoot forth their arms in every direction, in order to seize upon such insects as are near, and to devour them with great rapacity. Worms, the spawn of fish, and even muscles themselves, with their hard resisting shell, have been found in the stomachs of these voracious animals; and what is very extraordinary, though the substance of their own bodies be almost as soft as water, yet they are no way injured by swallowing these shells, which are almost of a stony hardness. They increase in size as all other animals do. In summer, when the water of the sea is warmed by the heat of the sun, they float upon the surface, and in the dark they send forth a kind of shining light resembling

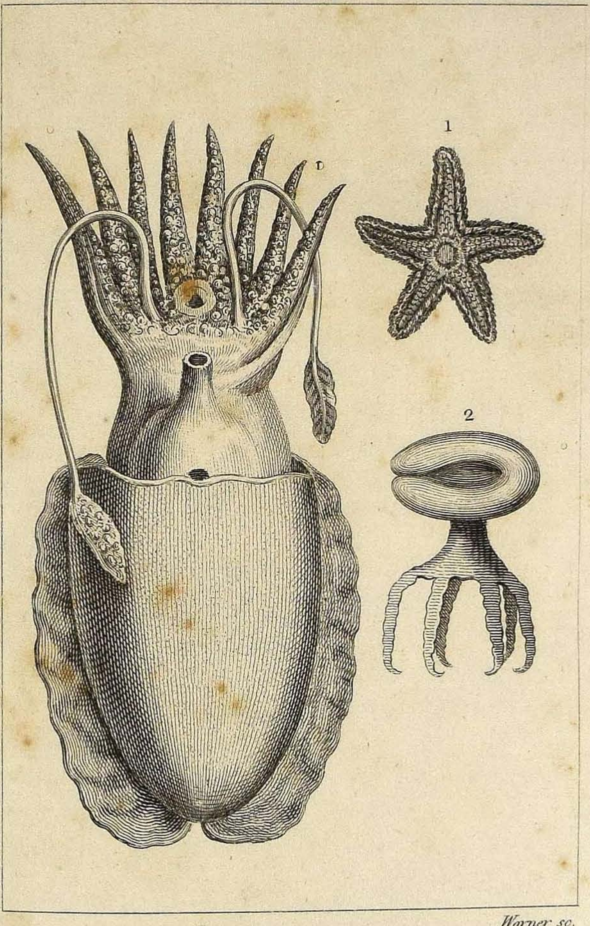
that of phosphorus. Some have given these animals the name of sea-nettles, because they burn the hands of those that touch them, as nettles are found to do. They are often seen fastened to the rocks, and to the largest sea-shells, as if to derive their nourishment from them. If they be taken and put into spirit of wine, they will continue for many years entire, but if they be left to the influence of the air, they are, in less than four-and-twenty hours, melted down into limpid and offensive water.

In all of this species, none are found to possess a vent for their excrements, but the same passage by which they devour their food, serves for the ejection of their fæces. These animals, as was said, take such a variety of figures, that it is impossible to describe them under one determinate shape; but in general, their bodies resemble a truncated cone, whose base is applied to the rock to which they are found usually attached. Though generally transparent, yet they are found of different colours, some inclining to green, some to red, some to white, and some to brown. In some, their colours appear diffused over the whole surface, in some, they are often streaked, and in others often spotted. They are possest of a very slow progressive motion, and in fine weather, they are continually seen, stretching out and fishing for their prey. Many of them are possest of a number of long slender filaments, in which they entangle any small animals they happen to approach, and thus draw them into their enormous stomachs, which fill the whole cavity of their bodies. The harder shells continue for some weeks undigested, but at length, they undergo a kind of maceration in the stomach, and become a part of

the substance of the animal itself. The indigestible parts are returned by the same aperture by which they were swallowed, and then the star-fish begins to fish for more. These also may be cut in pieces, and every part will survive the operation; each becoming a perfect animal, endued with its natural rapacity. Of this tribe, the number is various, and the description of each would be tedious and uninstructing; the manners and nature of all are nearly as described; but I will just make mention of one creature, which, though not properly belonging to this class, yet is so nearly related, that the passing it in silence would be an unpardonable omission.

Of all other animals, the Cuttle-fish, though in some respects superior to this tribe, possesses qualities the most extraordinary. It is about two feet long, covered with a very thin skin, and its flesh composed of a gelatinous substance, which however within side is strengthened by a strong bone, of which such great use is made by the goldsmith. It is possessed of eight arms, which it extends, and which are probably of service to it in fishing for its prey; while in life, it is capable of lengthening or contracting these at pleasure; but when dead, they contract and lose their rigidity. They feed upon small fish, which they seize with their arms; and they are bred from eggs, which are laid upon the weeds along the sea-shore.

The cuttle-fish is found along many of the coasts of Europe, but are not easily caught, from a contrivance with which they are furnished by nature; this is a black substance, of the colour of ink, which is contained in a bladder generally on the left-side of the belly, and which is ejected in the manner of an



Warner sc.

The Cuttle Fish.
1.The Sea Star.
2.The Sea Nettle.

excrement from the anus. Whenever therefore this fish is pursued, and when it finds a difficulty of escaping, it spurts forth a great quantity of this black liquor, by which the waters are totally darkened; and then it escapes, by lying close at the bottom. In this manner the creature finds its safety, and men find ample cause for admiration, from the great variety of stratagems with which creatures are endued for their peculiar preservation.

CHAP. IV.

Of the Polypus.

THOSE animals which we have described in the last chapter, are variously denominated. They have been called the Star-fish, Sea-nettles, and Sea-polypi. This last name has been peculiarly ascribed to them by the ancients, because of the number of feelers or feet of which they are all possest, and with which they have a slow progressive motion; but the moderns have given the name of Polypus to a reptile that lives in fresh water, by no means so large or observable. These are found at the bottom of wet ditches, or attached to the under surface of the broad-leafed plants that grow and swim on the waters. The same difference holds between these and the sea-water polypus, as between all the productions of the sea, and of the land and the ocean. The marine vegetables and animals grow to a monstrous size. The eel, the pike, or the bream of

fresh-waters, is but small; but in the sea, they grow to an enormous magnitude. The herbs of the field are at most but a few feet high; those of the sea often shoot forth a stalk of an hundred. It is so between the polypi of both elements. Those of the sea are found from two feet in length to three or four, and Pliny has even described one, the arms of which were no less than thirty feet long. Those in fresh waters, however, are comparatively minute; at their utmost size, seldom above three parts of an inch long, and when gathered up into their usual form, not above a third even of those dimensions.

It was upon these minute animals, that the power of dissection was first tried in multiplying their numbers. They had been long considered as little worthy the attention of observers, and were consigned to that neglect in which thousands of minute species of insects remain to this very day. It is true, indeed, that Reaumur observed, classed, and named them. By contemplating their motions, he was enabled distinctly to pronounce on their being of the animal, and not of the vegetable kingdom; and he called them polypi, from their great resemblance to those larger ones that were found in the ocean. Still, however, their properties were neglected, and their history unknown.

Mr. Trembley was the person to whom we owe the first discovery of the amazing properties and powers of this little vivacious creature; he divided this class of animals into four different kinds; into those inclining to green, those of a brownish cast, those of flesh colour, and those which he calls the polype de panache. The differences of structure in

these, as also of colour, are observable enough; but the manner of their subsisting, of seizing their prey, and of their propagation, is pretty nearly the same in all.

Whoever has looked with care into the bottom of a wet ditch, when the water is stagnant, and the sun has been powerful, may remember to have seen many little transparent lumps of jelly, about the size of a pea and flatted on one side; such also as have examined the under side of the broad-leafed weeds that grow on the surface of the water, must have observed them studded with a number of these little jelly-like substances, which were probably then disregarded, because their nature and history was unknown. These little substances, however, were no other than living polypi gathered up into a quiescent state, and seemingly inanimate, because either undisturbed, or not excited by the calls of appetite to action. When they are seen exerting themselves they put on a very different appearance from that when at rest; to conceive a just idea of their figure, we may suppose the finger of a glove cut off at the bottom; we may suppose also several threads or horns planted round the edge like a fringe. The hollow of this finger will give us an idea of the stomach of the animal, the threads issuing forth from the edges may be considered as the arms or feelers, with which it hunts for its prey. The animal, at its greatest extent, is seldom seen above an inch and an half long, but it is much shorter when it is contracted and at rest; it is furnished neither with muscles nor rings, and its manner of lengthening or contracting itself more resembles that of the snail, than worms, or any other insect. The polypus con-

tracts itself more or less, in proportion as it is touched, or as the water is agitated in which they are seen. Warmth animates them, and cold benumbs them; but it requires a degree of cold approaching congelation before they are reduced to perfect inactivity; those of an inch have generally their arms double, often thrice as long as their bodies. The arms, where the animal is not disturbed, and the season not unfavourable, are thrown about in various directions, in order to seize and entangle its little prey; sometimes three or four of the arms are thus employed, while the rest are contracted like the horns of a snail, within the animal's body. It seems capable of giving what length it pleases to these arms; it contracts and extends them at pleasure, and stretches them only in proportion to the remoteness of the object it would seize.

These animals have a progressive motion, which is performed by that power they have of lengthening and contracting themselves at pleasure; they go from one part of the bottom to another; they mount along the margin of the water, and climb up the side of aquatic plants. They often are seen to come to the surface of the water, where they suspend themselves by their lower end. As they advance but very slowly, they employ a great deal of time in every action, and bind themselves very strongly to whatever body they chance to move upon as they proceed; their adhesion is voluntary, and is probably performed in the manner of a cupping-glass applied to the body.

All animals of this kind have a remarkable attachment to turn towards the light, and this naturally might induce an enquirer to look for their eyes; but

however carefully this search has been pursued, and however excellent the microscope with which every part was examined, yet nothing of the appearance of this organ was found over the whole body; and it is most probable that, like several other insects which hunt their prey by their feeling, these creatures are unfurnished with advantages which would be totally useless for their support.

In the center of the arms, as was said before, the mouth is placed, which the animal can open and shut at pleasure, and this serves at once as a passage for food, and an opening for it after digestion. The inward part of the animal's body seems to be one great stomach, which is open at both ends; but the purposes which the opening at the bottom serves are hitherto unknown, but certainly not for excluding their excrements, for those are ejected at the aperture by which they are taken in. If the surface of the body of this little creature be examined with a microscope, it will be found studded with a number of warts, as also the arms, especially when they are contracted; and these tubercles, as we shall presently see, answer a very important purpose.

If we examine their way of living, we shall find these insects chiefly subsisting upon others, much less than themselves; particularly a kind of millepedes that live in the water, and a very small red worm, which they seize with great avidity. In short, no insect whatsoever, less than themselves, seems to come amiss to them: their arms, as was observed above, serve them as a net would a fisherman, or perhaps, more exactly speaking, as a lime-twig does a fowler. Wherever their prey is perceived, which the animal effects by its feeling, it is sufficient to

touch the object it would seize upon, and it is fastened without a power of escaping. The instant one of this insect's long arms is laid upon a millepede, the little insect sticks without a possibility of retreating. The greater the distance at which it is touched, the greater is the ease with which the polypus brings the prey to its mouth. If the little object be near, though irretrievably caught, it is not without great difficulty that it can be brought to the mouth and swallowed. When the polypus is unsupplied with prey, it testifies its hunger by opening its mouth; the aperture, however, is so small that it cannot be easily perceived; but when, with any of its long arms, it has seized upon its prey, it then opens the mouth distinctly enough, and this opening is always in proportion to the size of the animal which it would swallow; the lips dilate insensibly by small degrees, and adjust themselves precisely to the figure of their prey. Mr. Trembley, who took a pleasure in feeding this useless brood, found that they could devour aliments of every kind, fish and flesh as well as insects; but he owns they did not thrive so well upon beef and veal, as upon the little worms of their own providing. When he gave one of these famished reptiles any substance which was improper to serve for aliment, at first it seized the prey with avidity, but after keeping it some time entangled near the mouth, it let drop again with distinguishing nicety.

When several polypi happen to fall upon the same worm, they dispute their common prey with each other. Two of them are often seen seizing the same worm at different ends, and dragging it at opposite directions with great force. It often happens

that while one is swallowing its respective end, the other is also employed in the same manner, and thus they continue swallowing each his part, until their mouths meet together; they then rest, each for some time in this situation, till the worm breaks between them, and each goes off with his share; but it often happens, that a seemingly more dangerous combat ensues, when the mouths of both are thus joined upon one common prey together: the largest polypus then gapes and swallows his antagonist; but what is very wonderful, the animal thus swallowed seems to be rather a gainer by the misfortune. After it has lain in the conqueror's body for about an hour, it issues unhurt, and often in possession of the prey which had been the original cause of contention; how happy would it be for men, if they had as little to fear from each other!

These reptiles continue eating the whole year, except when the cold approaches to congelation; and then, like most others of the insect tribe, they feel the general torpor of nature, and all their faculties are for two or three months suspended; but if they abstain at one time, they are equally voracious at another, and like snakes, ants, and other animals that are torpid in winter, the meal of one day suffices them for several months together. In general, however, they devour more largely in proportion to their size, and their growth is quick exactly as they are fed; such as are best supplied, soonest acquire their largest size, but they diminish also in their growth with the same facility, if their food be taken away.

Such are the more obvious properties of these little animals, but the most wonderful still remain behind:

their manner of propagation, or rather multiplication, has for some years been the astonishment of all the learned of Europe. They are produced in as great a variety of manners as every species of vegetable. Some polypi are propagated from eggs, as plants are from their seed; some are produced by buds issuing from their bodies, as plants are produced by inoculation, while all may be multiplied by cuttings, and this to a degree of minuteness that exceeds even philosophical perseverance.

With respect to such of this kind as are hatched from the egg, little curious can be added, as it is a method of propagation so common to all the tribes of insect nature; but with regard to such as are produced like buds from their parent stem, or like cuttings from an original root, their history requires a more detailed explanation. If a polypus be carefully observed in summer, when these animals are chiefly active, and more particularly prepared for propagation, it will be found to burgeon forth from different parts of its body several tubercles or little knobs, which grow larger and larger every day; after two or three days inspection, what at first appeared but a small excrescence takes the figure of a small animal, entirely resembling its parent, furnished with feelers, a mouth, and all the apparatus for seizing and digesting its prey. This little creature every day becomes larger, like the parent, to which it continues attached; it spreads its arms to seize upon whatever insect is proper for aliment, and devours it for its own particular benefit; thus it is possessed of two sources of nourishment, that which it receives from the parent by the tail, and that which it receives from its own industry by the mouth. The

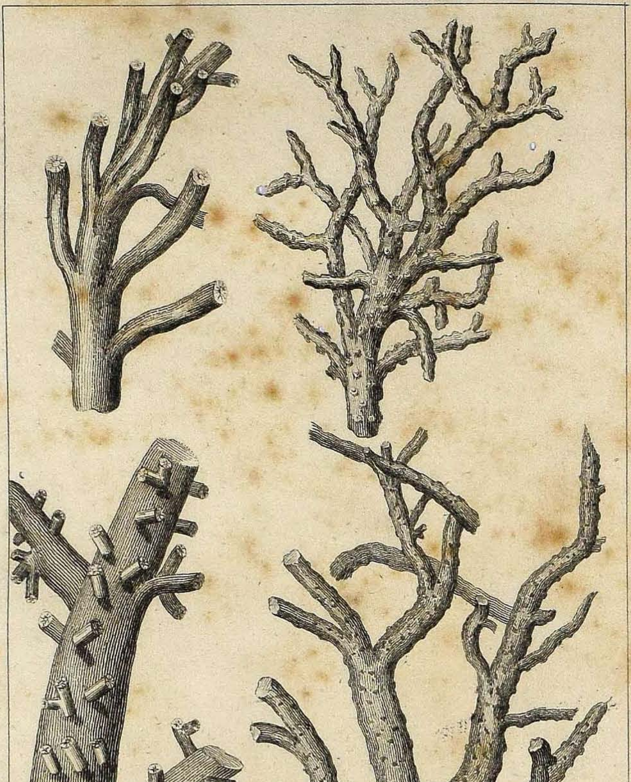
food which these animals receive often tinctures the whole body, and upon this occasion the parent is often seen communicating a part of its own fluids to that of its progeny that grows upon it; while, on the contrary, it never receives any tincture from any substance that is caught and swallowed by its young. If the parent swallows a red worm, which gives a tincture to all its fluids, the young one partakes of the parental colour; but if the latter should seize upon the same prey, the parent polypus is no way benefited by the capture, but all the advantage remains with the young one.

But we are not to suppose that the parent is capable of producing only one at a time, several young ones are thus seen at once, of different sizes, growing from its body, some just budding forth, others acquiring their perfect form, and others come to sufficient maturity, and just ready to drop from the original stem to which they had been attached for several days. But what is more extraordinary still, those young ones themselves that continue attached to their parent, are seen to burgeon, and propagate their own young ones also, each holding the same dependence upon its respective parent, and possessed of the same advantages, that have been already described in the first connection. Thus we see a surprising chain of existence continued, and numbers of animals naturally produced without any union of the sexes, or other previous disposition of nature.

This seems to be the most natural way by which these insects are multiplied; their production from the egg being not so common; and though some

of this kind are found with a little bladder attached to their bodies, which is supposed to be filled with eggs, which afterwards come to maturity, yet the artificial method of propagating these animals, is much more expeditious, and equally certain: it is indifferent whether one of them be cut into ten, or ten hundred parts, each becomes as perfect an animal as that which was originally divided; but it must be observed, that the smaller the part which is thus separated from the rest, the longer it will be in coming to maturity, or in assuming its perfect form. It would be endless to recount the many experiments that have been tried upon this philosophical prodigy; the animal has been twisted and turned into all manner of shapes; it has been turned inside out, it has been cut in every division, yet still it continued to move; its parts adapted themselves again to each other, and in a short time it became as voracious and industrious as before.

Besides these kinds mentioned by Mr. Trembley, there are various others which have been lately discovered by the vigilance of succeeding observers, and some of these so strongly resemble a flowering vegetable in their forms, that they have been mistaken by many naturalists for such. Mr. Hughes, the author of the Natural History of Barbadoes, has described a species of this animal, but has mistaken its nature, and called it a sensitive flowering plant; he observed it to take refuge in the holes of rocks, and when undisturbed, to spread forth a number of ramifications, each terminated by a flowery petal which shrunk at the approach of the hand, and



Warner sc.

The Coral-plants.

withdrew into the hole from whence before it had been seen to issue. This plant however was no other than an animal of the polypus kind, which is not only to be found in Barbadoes, but also on many parts of the coast of Cornwall, and along the shores of the Continent.

CHAP. V.

Of Lythophytes and Sponges.

It is very probable that the animals we see, and are acquainted with, bear no manner of proportion to those that are concealed from us. Although every leaf and vegetable swarms with animals upon land, yet at sea they are still more abundant; for the greatest part of what would seem vegetables growing there, are in fact nothing but the artificial formation of insects, palaces which they have built for their own habitation.

If we examine the bottom of the sea along some shores, and particularly at the mouths of several rivers, we shall find it has the appearance of a forest of trees under water, millions of plants growing in various directions, with their branches entangled in each other, and sometimes standing so thick as to obstruct navigation. The shores of the Persian Gulph, the whole extent of the Red-Sea, and the western coasts of America, are so choaked up in

many places with these coraline substances, that though ships force a passage through them, boats and swimmers find it impossible to make their way. These aquatic groves are formed of different substances, and assume various appearances. The coral plants, as they are called, sometimes shoot out like trees without leaves in winter; they often spread out a broad surface like a fan, and not uncommonly a large bundling head, like a faggot; sometimes they are found to resemble a plant with leaves and flowers; and often the antlers of a stag, with great exactness and regularity. In other parts of the sea are seen sponges of various magnitude, and extraordinary appearances, assuming a variety of phantastic forms, like large mushrooms, mitres, fonts, and flower-pots. To an attentive spectator these various productions seem entirely of the vegetable kind; they seem to have their leaves and their flowers, and have been experimentally known to shoot out branches in the compass of a year. Philosophers, therefore, till of late, thought themselves pretty secure in ascribing these productions to the vegetable kingdom; and Count Marsigli, who has written very laboriously and learnedly upon the subject of corals and sponges, has not hesitated to declare his opinion, that they were plants of the aquatic kind, furnished with flowers and seeds, and endued with a vegetation entirely resembling that which is found upon land. This opinion, however, some time after, began to be shaken by Rumphius and Jussieu, and at last by the ingenious Mr. Ellis, who, by a more sagacious and diligent enquiry into nature, put it past doubt,

that corals and sponges were entirely the works of animals, and that like the honey-comb, which was formed by the bee, the coral was the work of an infinite number of reptiles of the polypus kind, whose united labours were thus capable of filling whole tracts of the ocean with those embarrassing tokens of their industry.

If in our researches after the nature of these plants, we should be induced to break off a branch of the coraline substance, and observe it carefully, we shall perceive its whole surface, which is very rugged and irregular, covered with a mucous fluid, and almost in every part studded with little jelly-like drops, which when closely examined, will be found to be no other than reptiles of the polypus kind. These have their motions, their arms, their appetites, exactly resembling those described in the last chapter, but they soon expire when taken out of the sea, and our curiosity is at once stopped in its career, by the animals ceasing to give any marks of their industry; recourse therefore has been had to other expedients, in order to determine the nature of the inhabitant, as well as the habitation.

If a coraline plant be strictly observed, while still growing in the sea, and the animals upon its surface be not disturbed, either by the agitation of the waters, or the touch of the observer, the little polypi will then be seen in infinite numbers, each issuing from its cell, and in some kinds, the head covered with a little shell resembling an umbrella, the arms spread abroad, in order to seize its prey, while the hinder part still remains attached

to its habitation, from whence it never wholly removes. By this time it is perceived that the number of inhabitants is infinitely greater than was at first suspected; that they are all assiduously employed in the same pursuits, and that they issue from their respective cells, and retire into them at pleasure. Still, however, there are no proofs that those large branches which they inhabit are entirely the construction of such feeble and minute animals. But chemistry will be found to lend a clue to extricate us from our doubts in this particular. Like the shells which are formed by snails, muscles and oysters, these coraline substances effervesce with acids, and may therefore well be supposed to partake of the same animal nature. But Mr. Ellis went still farther, and examined their operations, just as they were beginning. Observing an oyster-bed which had been for some time neglected, he there perceived the first rudiments of a coraline plantation, and tufts of various kinds shooting from different parts of this favourable soil. It was upon these he tried his principal experiment. He took out the oysters which were thus furnished with coralines, and placed them in a large wooden vessel, covering them with sea-water. In about an hour he perceived the animals, which before had been contracted by handling, and had shewn no signs of life, expanding themselves in every direction, and appearing employed in their own natural manner. Perceiving them therefore in this state, his next aim was to preserve them thus expanded, so as to be permanent objects of curiosity.. For this purpose he poured, by slow degrees, an equal quantity of boil-

ing water into the vessel of sea-water in which they were immersed. He then separated each polypus with pincers from its shell, and plunged each separately into small crystal vases, filled with spirit of wine mixed with water. By this means the animal was preserved entire, without having time to contract itself, and he thus perceived a variety of kinds, almost equal to that variety of productions which these little animals are seen to form. He has been thus able to perceive and describe fifty different kinds, each of which is seen to possess its own peculiar mode of construction, and to form a coraline that none of the rest can imitate. It is true indeed, that on every coraline substance there are a number of polypi found, no way resembling those which are the erectors of the building; these may be called a vagabond race of reptiles, that are only intruders upon the labours of others, and that take possession of habitations, which they have neither art nor power to build for themselves. But in general, the same difference that subsists between the honeycomb of the bee, and the paper-like cells of the wasp, subsists between the different habitations of the coral-making polypi.

With regard to the various forms of these substances, they have obtained different names, from the nature of the animal that produced them, or the likeness they bear to some well-known object, such as coralines, fungi-madrepores, sponges, astroites, and keratophytes. Though these differ extremely in their outward appearances, yet they are all formed in the same manner, by reptiles of various kinds and nature. When examined chemically, they all

discover the marks of animal formation; the corals, as was said, dissolve in acids, the sponges burn with an odour strongly resembling that of burnt horn. We are left somewhat at a loss with regard to the precise manner in which this multitude of cells, which at last assume the appearance of a plant or flower, are formed. If we may be led in this subject by analogy, it is most probable, that the substance of coral is produced in the same manner that the shell of the snail grows round it; these little reptiles are each possessed of a slimy matter, which covers its body, and this hardening, as in the snail, becomes an habitation exactly fitted to the body of the animal that is to reside in it; several of these habitations being joined together, form at length a considerable mass, and as most animals are productive, in proportion to their minuteness, so these multiplying in a surprising degree, at length form those extensive forests that cover the bottom of the deep.

Thus all nature seems replete with life; almost every plant on land has its surface covered with millions of these minute creatures, of whose existence we are certain, but of whose uses we are entirely ignorant; while numbers of what seem plants at sea are not only the receptacles of insects, but also entirely of insect formation. This might have led some late philosophers into an opinion, that all nature was animated, that every, even the most inert mass of matter, was endued with life and sensation, but wanted organs to make those sensations perceptible to the observer: those opinions, taken up at random, are difficultly maintained, and as difficultly refuted; like combatants that meet in the

dark, each party may deal a thousand blows without ever reaching the adversary. Those perhaps are wiser who view nature as she offers; who without searching too deeply into the recesses in which she ultimately hides, are contented to take her as she presents herself, and storing their minds with effects, rather than with causes, instead of the embarrassment of systems, about which few agree, are contented with the history of appearances, concerning which all mankind have but one opinion.

INDEX.

INDEX.

The Roman character denotes the volume, the Arabic number the page.

A.

Abdominal Fish, their description, v. 120.

Abstemious life, its great benefit, ii. 63.

Abstinence, religiously observed long after the Reformation—queen Elizabeth's injunctions upon this head—a heavenly institution, from its benefit and advantage to society, ii. 7. ——Remarkable instance of it in the sloth, iii. 405.

Acanthopterigii, the prickly-finned fish, v. 120.

Acorn-shell, v. 250.

Ælian, has seen an elephant write latin, iii. 339.

Ætna, a volcano in Sicily—remarkable eruption in 1537, i. 77.

Aeolipile, an instrument to produce artificial wind—its description, and manner of generating violent blasts, i. 279.

Africa, its sandy storms, i. 300.——destroy villages and armies, 303——several animals with four stomachs in Europe, have but two in Africa, ii. 152.

Age, the mountains of Scotland, Wales, Auvergne, and Switzerland, furnish more instances of old age, than the plains of Holland, Flanders, Germany, or Poland, ii. 64.

Agouti, an animal found in great abundance in South America, and by some called the rabbit of that continent; it resembles the rabbit, yet is different from ours, and peculiar to the new world—its description—its ordinary food—it has the hair and voraciousness of a hog—eats greedily, and hides the remainder—burrows in hollow trees—its manner of feeding and walking—sight and hearing—its flesh, how dressed—how hunted and forced out of its hole—it turns in its own defence upon the hunters—its bite, and cry—how tamed—bears two young at each litter; breeds at least twice a year; carries its young about like a cat, and lodges them in a

tree, where they soon become able to provide for themselves, iii. 155 to 158.
Agricola, has seen hats made of mole skins, most beautiful, iii. 195.
Ai, a name of the sloth—its description, iii. 402.
Aigues-mortes, town in France, a port in the time of St. Louis; now removed more than four miles from the sea, i. 230.
Air, the only active agent in earthquakes, i. 89——Amonton's calculation of a moderate degree of heat sufficient to give the air amazing powers of expansion, 89—account of the properties of, 247.
Air-pump, the experiment of a carp placed under it, v. 15, 16—fish can live but a few minutes without air, 16.
Air-bladder, in fishes, described, v. 16.
Albatross, a bird of the gull kind—its description by Edwards—is an inhabitant of the tropical climates, and other regions, as far as the streights of Magellan in the South Seas—is the most fierce and formidable of the aquatic tribe—it chiefly pursues the flying-fish, forced from the sea by the dolphins—Wicquefort's account of this bird—it seems to have a peculiar affection for the penguin, and a pleasure in its society—its nest, iv. 360.
Albouras, a famous volcano near mount Taurus, i. 84.
Alder, hares will not feed on the bark of it, iii. 121.
Algazel, the seventh variety of gazelles with Mr. Buffon, ii. 280.
Aldrovandus, places the bats among birds, iii. 226.
Alexander's soldiers agitated by curiosity and apprehension at the tides in the river Indus, i. 215.
Aligator, or the *Cayman*, a kind of crocodile, v. 294.
Alps, dreadful chasms found in them, i. 52—Pope's description of a traveller straining up the Alps, 120—the highest point of them not above sixteen hundred toises above the surface of the sea, 128.
Amazon, the greatest river in the world, has its source among the Andes, i. 119—its course, from its origin in the lake of Lauricocah to its discharge into the Western Ocean, is more than twelve hundred leagues—its discharge is through a channel of an hundred and fifty miles broad, after receiving above sixty considerable rivers, 181.
Ambergrise, long considered as a substance found floating on the sea, but since discovered to belong to the cachalot, v. 53.—See Cachalot.
Ambrose, St. his credulity concerning the halcyon, iv. 423.
America, exceeds in the size of its reptiles, but is inferior in its quadrupeds, ii. 164.——The black rats, originally from Europe, have propagated greatly in America, and are now the most noxious animals there, iii. 172.——The American mock-bird, assumes the tone of every animal in the wood,

from the wolf to the raven—its description and habits, iv. 254.——Catesby asserts the wolf was the only dog used by the Americans, before they had the Europeans among them, iii. 42——the tapir is the largest animal of America—opinion that all quadrupeds in South America are of a different species from those resembling them in the Old World—and such as peculiarly belong to that New Continent are without the marks of the quadruped perfection, ii. 164—description of the natives of that country, 84.——The savages there suppose monkies to be men, but obstinately dumb, to avoid being compelled to labor, iii. 311—the vampyre, considered as a great pest of South America—and an obstruction to the peopling of many parts of that continent, 233—the manufacture of stuffs, of the wool of the pacos, a very considerable branch of commerce in South America, 383—no rabbits naturally in America—but there are animals in some measure resembling the rabbits of Europe, 133.——That part of the American continent which lies under the line is cool and pleasant, ii. 88—cause of the tawney colour of the North American Indians—they paint their skins with red ochre, and anoint them with the fat of bears, 90—the original cause of their flat heads, 92.——American wood-duck described, iv. 412.

Amia, or *Bonito*, description of this fish, v. 129.

Ammodytes, or the *Lance*, a fish, its description, v. 127.

Ammodytes, a kind of viper—it darts with amazing swiftness, v. 377.

Amonton observes, a moderate degree of heat may give the air amazing powers of expansion, i. 89.

Amour, a river of Eastern Tartary, i. 176—it receives about forty lesser rivers, 183.

Amphibious quadrupeds have motion in the lower eye-lid alone, i. 411——general description of that class, iii. 235.

Amphisbœna, or the double-headed serpent, v. 376.

Anarchicas, the wolf-fish, its description, v. 126.

Anchovy has no bladder, v. 18.

Andalusia, gennets of that province the best, ii. 184.

Andes, amazing chasms or fissures in them—some of these are a mile wide, and others, running under ground, resemble a province, i. 53—the highest mountains of the world, 84—excellent description of them by Ulloa, 123—the Andes are by measure three thousand one hundred and thirty-six toises, or fathoms, above the surface of the sea, 127—at the top no difficulty of breathing perceived, 129.——Manner of mules going down the precipices, ii. 208.

Anemometer, an instrument to measure the velocity of the wind—gives no certain information of the force of a storm, i. 293.

Angora. The goat of Angora—a number of animals about An-

gora, affording hair for trade—the camlet made of such hair, ii. 264—the cat of Angora, 390.

Anhima, a bird of the crane kind, of Brasil, described—the cock and the hen prowl together—when one dies, the other stays by it, and dies also, iv. 306.

Animals hold the first rank amidst the infinitely different productions the earth offers—are endowed with powers of motion and defence, even those fixed to one spot—organized beings, provided with some defence for their own security—endued with life and vigour—some, by nature, violent—have their enmities and affections—ultimately supported upon vegetables —those in a dry sunny climate strong and vigorous—different vegetables appropriated to the different appetites, and why—of domestic kinds, carried from milder countries into northern climates, quickly degenerate and grow less—in the internal parts of South America and Africa grow to a prodigious fize, and why—not so in the cold frozen regions of the North—the most perfect races have the least similitude to the vegetable productions on which they are ultimately fed—the meaner the animal, the more local—assume different habits as well as appearances, and why—some peculiar to every part of the vegetable system—there are that live upon other animals—this wisely so constituted to diminish the number of animals, and encrease that of vegetables—the general scope of human industry—of the vast variety, very few serviceable to man—in a catalogue of more than twenty thousand land animals, scarcely an hundred are any way useful to man—expediency of man's living upon animals as well as vegetables, i. 346 to 356—little more known than that the greatest number require the concurrence of a male and female to reproduce their kind—and these, distinctly and invariably, found to beget creatures of their own species, 356—such parts as the animal has double, or without which it can live, are the latest in production, 372—De Graaf has attended the progress and increase of various animals in the womb, and minutely marked the changes they undergo, 373—that which, in proportion to its bulk, takes the longest time for production, the most complete when finished—of all others, man the slowest in coming into life—the most formidable are the least fruitful, and why—those which bring forth many engender before they have arrived at half their natural size—approach more to perfection, whose generation nearly resembles that of man, 383—men and apes only have eye-lashes upon the upper and lower lids—all others want them on the lower lid, 410—that which has most desires appears capable of the greatest variety of happiness—those of the forest remain without food several weeks—all endure the want of sleep and hunger with less injury to health than man—nature contracts the stomachs of carnivorous animals of the forest to suit them to their precarious way

of living—but the meaner tribes are still more capable of sustaining life without food, ii. 1—those furnished with hands have more understanding than others, 51—in general the large animals live longer than the little, 62—difference between animals in a state of nature and domestic tameness, so considerable that M. Buffon makes it a principal distinction of classes, 146—their teeth fitted to the nature of their food—and their legs as well fitted to their respective wants or enjoyments—those who chew the cud have four stomachs—several that with us have four stomachs, have but two in Africa—no carnivorous animal, except the dog, makes a voluntary attack but with superiority—the stomach generally proportioned to the nature of the food, or the ease with which it is obtained—the size of the intestines proportioned to the nature of the food—few of the wild sort seek their prey in the day-time—in proportion as each carnivorous animal wants strength, it uses all the assistance of patience, assiduity, and cunning—some animals carefully avoid their enemies by placing centinels to warn the approach of danger, and know how to punish such as have neglected their post, or been unmindful of the common safety—the wild sort subject to few alterations, and in the savage state continue for ages the same, in size, shape, and colour—is otherwise when subdued and taken under the protection of man—the tame kind bears no resemblance to its ancestors in the woods, animals feeding only upon grass, rendered carnivorous—two instances, 150—Africa ever remarkable for the fierceness of its animals—the smallest multiply the fastest—the larger sort bring few at a time—seldom generate till they be near their full growth—those which bring many reproduce before they arrive at half their natural size—with all animals, the time of their pregnancy is proportioned to their size—best method of claſſing animals adopted by Ray, Klein, Brisson, and Linnæus, 136—the author's method of claſſing them, 139—the carnivorous seek their food in gloomy solitude—they are sharper than the ruminating kind, and why—ruminating animals most harmless, and most easily tamed—generally go in herds, for their mutual security—live entirely upon vegetables—the meanest of them unite in each other's defence—carnivorous animals have small stomachs and short intestines—ruminating animals naturally more indolent and less artful than the carnivorous kinds, and why—their bowels considered as an elaboratory, with proper vessels in it—nature enlarges the capacity of their intestines to take in a greater supply—and furnishes them with four stomachs—the names of these four stomachs—the intestines of carnivorous animals are thin and lean; but those of the ruminating sort strong, fleshy, and well covered with fat—of all others, man spends the least time in eating—of all ruminant, the cow kind deserve the first rank, ii. 217—naturalists give various names to the same,

only differing in accidental circumstances—of all, except man, the cow most extensively propagated—greatest variety among cows, none more humble and pliant of disposition—the large kind of the torrid zone very fond of the water—the number of the cow kind, by naturalists extended to eight or ten sorts, reduced to two—all the ruminant internally much alike, 236—those that take refuge under the protection of man, in a few generations, become indolent and helpless—the sheep, in a domestic state, the most defenceless and inoffensive, 239—of all in the world, the gazelle has the most beautiful eye, 278—scarcely one animal, except the carnivorous, that does not produce concretions in the stomach, intestines, kidnies, bladder, or in the heart, 282—by a general rule, every animal lives about seven or eight times the number of years it continues to grow, 304—of all natives of this climate, none have such a beautiful eye as the stag, 305—no two more nearly allied than the stag and the fallow-deer; yet form distinct families, and never engender together, 320—those living upon flesh hunt by nature, iii. 6—all under the influence of man are subject to great variations, 8—those of the north, in winter, are more hairy than those of the milder climates, and what the cause, 7(—of the arctic climates, have their winter and summer garments, except as far north as Greenland, 78—of the weazle kind, the martin the most pleasing, 88—feeding entirely upon vegetables, are inoffensive and timorous, 117—remarkable for speed, except the horse, have the hind feet longer than the fore, 119—none receives the male when pregnant, except the hare, 120—all are tamed more difficultly in proportion to their cowardice, 174—in all countries, civilized and improved, the lower ranks of animals repressed and degraded, 243.

Antelope, its description, ii. 276.

Antlers, their distinct names, ii. 312.

Antiparos, its grotto most remarkable, i. 58.

Antipathy, many have it to some animals, whose presence they instantly smell, ii. 48.——Dogs and wolves so different in their dispositions, that no animals can have a more perfect antipathy, iii. 33—the same subsists between the jackall and the dog, 59.

Antiquity, most naturally looked up to with reverential wonder, ii. 111.

Ants, the natural history of, vi. 130.

Ant-lion, the, vi. 7.

Ant-eater, or *Ant-bear*, description and habits—their art to catch the ants—manner of defence against its enemies—kills the invader, and remains fastened upon him with vindictive desperation, iii. 397.

Antioch, buried by an earthquake, i. 93.

Aorta, the great artery, i. 380.

INDEX.

Aperea, by some the Brafilian rabbit—its description, iii. 160.

Apes, have eye-lashes upon the upper and lower lids, i. 410—the only animal poffeffed of hands, and arms, 420—in some of the kind the resemblance to man so striking, that anatomists are puzzled to find in what part of the human body man's superiority consists—enjoy many advantages in common with men, above the lower tribes of nature, 147——the foremost of the kind is the ourang-outang, or wild man of the woods—description of this animal by Dr. Tyson—comparative view of this creature with man--another description of it by Mr. Buffon—two young ones, but a year old, discovered an astonishing power of imitation—a kind called baris, properly instructed when young, serve as useful domestics—Le Comte's account of an ape in the streights of Molucca—the long-armed ape an extraordinary and remarkable creature—its description—a native of the East Indies, and found along the coasts of Coromandel—fling themselves from one rope to another, at thirty, forty, and fifty feet distance—instances of amazing nimbleness—in a state of nature they run upon all-fours—certain proofs of it—slight survey of the ape kind, iii. 277——in the navies of Solomon, among the articles imported from the East, are apes and peacocks, iv. 133.

Apicius, noted for having taught mankind to suffocate fish in Carthaginian pickle, v. 25——his receipt for making sauce for the Ostrich, iv. 45.——his manner of dressing a hare in true Roman taste, iii. 127.

Apodal, the name of the fish without ventral fins, v. 120.

Appendices in the intestines of birds, iv. 12.

Appetite, nature, by supplying a variety, has multiplied life in her productions, iv. 60.

Arabia, its sandy tempests described, i. 300.——Men and animals buried in the sands of Arabia, preserved from corruption, for several ages, as if actually embalmed, ii. 119—the ass originally a native of Arabia, 206. See *Horfes*, *Camel*.

Archimedes, discovered the method of determining the purity of gold, by weighing it in water, i. 159.

Archipelago, very good horses in its islands, ii. 187.——the wild ass found in those islands, particularly Cerigo, ii. 200.

Ardebil, the pastures in those plains excellent for rearing horses, ii. 188.

Arequipa, a celebrated burning mountain in Peru, i. 84.

Argentine, description of this fish, v. 128.

Argonaut, or *Paper-nautilus*, described, v. 229.

Arion, by his harp, gathered the dolphins to the ship's fide, ii. 38.

Ariftotle's opinion about the formation of the incipient animal, i. 357—and mules being sometimes prolific, 199.

Arlotto, an Italian Franciscan friar—for his fleeping transgressions taken before the inquifition, and like to be condemned for them, ii. 16.

Armadilla, or *Tatou*, generally referred to the tribe of insects or snails, ii. 149—an inhabitant of South America—a harmless creature, furnished with a peculiar covering for its defence—attacked without danger, and liable to persecutions—is of different fizes; in all, however, the animal is partially covered with a coat of mail, a striking curiofity in natural history—has the same method of protecting itself as the hedgehog or pangolin—when attacked, rolls itself up in its shells, like a ball, and continues so till the danger is over—the Indians take it in this form, lay it close to the fire, and oblige it to unfold—this animal utterly unknown before the discovery of America—does mischief in gardens—bears the cold of our climate without inconvenience—the mole does not burrow swifter than the armadilla—burrows deeper in the earth—expedients used to force them out—manner of taking them alive, sometimes in snares by the sides of rivers, and low moist places, which they frequent—never found at any distance from their retreats—near a precipice, escapes by rolling itself up, and tumbling down from rock to rock, without danger or inconvenience—its food—scarcely any that do not root the ground like a hog—a kind of friendship between them and the rattle-snake, they are frequently found in the same hole—they all resemble each other, as clothed with a shell, yet differ in size, and in the division of their shell—the various kinds—the pig-headed sort, the weasel-headed, the kabassou, and the encoubert are the largest, iii. 218, &c.

Arno, the river, a considerable piece of ground gained at the mouth of it, i. 229.

Aro, numbers of birds of paradife seen there, iv. 201.

Arsenius, tutor to the Emperor Arcadius, lived an hundred and twenty years, ii. 8.

Arts, fault that has infected most of our dictionaries and compilations of natural history, ii. 144.

Asia, aim of the Asiatics to possess many women, and to furnish a seraglio their only ambition, i. 400—lustre of jewels and splendor of brilliant colours eagerly sought after by all conditions of men, 421.

Asia Minor, description of its inhabitants, ii. 85.

Asiatic, the olive-coloured, claims the hereditary resemblance to our common parent—an argument to prove the contrary. ii. 92.

Asp, a kind of serpent, v. 369.

Asphaltum, an injection of petroleum and an application of asphaltum suffice to make a mummy, ii. 128.

Ass and horse, though nearly alike in form, are distinct kinds, different in nature—with only one of each kind, both races would be extinguished—in the state of nature entirely different —wild ass in greater abundance than the wild horse—wild ass

and the zebra a different species—countries where the wild ass is found—some run so swift, few coursers can overtake them—caught with traps—taken chiefly for their flesh and skins, which make that leather called shagreen—entertainment of wild asses in Persia seen by Olearius—the delicacy of its flesh a proverb there—Galen deems it unwholesome—asses originally imported into America by the Spaniards, have run wild, and multiplied to such numbers as to be a nuisance—chace of them in the kingdom of Quito—have all the swiftness of horses—declivities and precipices do not retard their career—after the first load, their celerity leaves them, their dangerous ferocity lost, and they contract the stupid look and dullness peculiar to the asinine species—will not permit a horse to live among them—always feed together—and a horse straying where they graze, they fall upon, and bite and kick him till he be dead—their preference of the plantane to any other vegetable—they drink as soberly as they eat, and never dip the nose into the stream—fear to wet their feet, and turn out to avoid the dirty parts of a road—shew no ardour but for the female, and often die after covering—scent an owner at a distance, and distinguish him in a crowd—with eyes covered, they will not stir a step—when laid down, one eye covered with the grass, and the other hidden with a stone, or other contiguous body, they will not stir, or attempt to rise, to get free from impediments—several brought up to perform, and exhibited at a show—suffered to dwindle every generation, and particularly in England—bulk for bulk, an ass stronger than a horse, and surer footed—also less apt to start than the horse—more healthy than the horse—Persians cleave their nostrils to give more room for breathing—Spaniards alone know the value of the ass—the Spanish jack-ass above fifteen hands high—the ass originally a native of Arabia—warm climates produce the largest and best—entirely lost among us during the reign of queen Elizabeth—Holingshed pretends our land yields no asses, yet they were common in England before that time—in Sweden they are a sort of rarity—by the last history of Norway, they had not reached that country—in Guinea they are larger and more beautiful than the horses of that country—in Persia are two kinds—some sold for forty or fifty pounds—no animal covered with hair less subject to vermin—lives till twenty or twenty-five—sleeps less than the horse, and never lies down, unless much tired—she-ass crosses fire and water to protect her young—the gimerro, bred between the ass and the bull—the size and strength of our asses improved by importation of Spanish jack-asses, ii. 197, &c.——Destroyed by the South American bat, called vampyre, iii. 235.

Assafœtida, savage nations delighted with the smell, ii. 48.

INDEX.

Assiniboils, lake, where the river St. Lawrence takes its rise, i. 182.

Astroites, among coral substances, vi. 197.

Atalantis, an island submersed, was as large as Asia Minor and Syria—the fruits of the earth offered without cultivation, i. 113.

Athanatus, instance of his strength, i. 436.

Athelston, prohibited the exportation of mares and stallions, except as presents, ii. 194.

Athenians had their cock-matches, iv. 126. See *Quail-fighting*, iv. 163.

Atherine, description of this fish, v. 128.

Atmosphere, most disorders incident to mankind, says Bacon, arise from changes of the atmosphere, v. 19.

Attraction defined—the sun possessed of the greatest share, i. 3.

Auk, a bird bred in the island of St. Kilda, iv. 389.

Avosetta, or scooper, a bird of the crane-kind, found in Italy—now and then seen in England—description, and extraordinary shape of its bill, iv. 329.

Aurelia, one of the appearances of the caterpillar, vi. 47, &c. —laying it in a warm room, Mr. Reaumur hastened the disclosure of the butterfly, and by keeping it in an ice-house, retarded it—though it bears a different appearance, it contains all the parts of the butterfly, in perfect formation—some insects continue under that form not above ten days, some twenty, some several months, others for a year together, 62—how the butterfly gets rid of that covering, 63—aurelia of the bee different from that of the common caterpillar, vi. 103.

Aurora, or the Samiri, the smallest and most beautiful of the sapajou monkies—its description—is very tender, delicate, and held in high price, iii. 316.

Aurora Borealis, or northern light, streams with peculiar lustre, and a variety of colours, round the pole—its appearance almost constant in winter—and, when the sun departs for half a year, this meteor supplies its beams, affording light for all the purposes of existence, i. 331.

Auvergne, in France, an amazing mummy dug up at that place, ii. 125.

Axis, a kind of beautiful stag—its description, ii. 318.

Azores, serpents, adders, and snakes, seen about these islands by Sir Robert Hawkins in 1590, i. 200.

B

Baboon, survey of the baboon kind, iii. 276—fierce, malicious, ignorant, and untractable—its description—impelled by a hatred for the males of the human species, and a desire for women—the chevalier Forbin relates, that in Siam, whole troops will sally forth, plunder the houses of provisions, and endeavour to force the women—manner of robbing an orchard or vineyard at the Cape of Good Hope—the female brings forth one at a time, carries it in her arms, clinging to her breast—at the Cape of Good Hope, the young of these animals are taught to guard houses, and perform the duty with punctuality—they seem insensible of the mischief they do—a baboon described by Mr. Buffon—their food—are not found to breed in our climate—are not carnivorous—their liver, like that of a dog, divided into six lobes—the largest of the kind is the mandril—its description—displeased it weeps like a child—is a native of the Gold Coast;—that called wanderow chiefly seen in the woods of Ceylon and Malabar—its description;—the maimon of Buffon, by Edwards called the pig-tail, the last of the sort, its description—a native of Sumatra, 293, &c.

Baby, the name of a dwarf, whose complete history is very accurately related by Mr. Daubenton, ii. 104.

Babyrouessa, the Indian hog, its description—travellers call it the hog of Borneo—in what manner it escapes the pursuers—has enormous tusks of fine ivory, less dangerous than the wild boar—the tusks have points directed to the eyes, and sometimes grow into them—these animals, in a body, are seen with the wild boars, with which they are not known to engender—are easily tamed—have a way of reposing different from other animals of the larger kind, by hitching one of their upper tusks on the branch of a tree, and suffering their whole body to swing down at ease—they are fierce and terrible when offended, and peaceable and harmless when unmolested—their flesh good to be eaten, but said to putrify in a short time—they chiefly live upon vegetables and the leaves of trees—are found in the island of Borneo, and in other parts of Asia and Africa, ii. 375, &c.

Bacon finely remarks the investigation of final causes is a barren study, i. 15—his hints for a regular history of the winds, 280.——Observes most of the disorders incident to mankind arise from the changes and alterations of the atmosphere—his observations upon fishes, v. 19.——Asserts that toads are found lodged in the bosom of rocks, or cased within the body of an oak-tree, without the smallest access on any side, either for nourishment or air, v. 280.

Badger, a solitary stupid animal—forms a winding hole, and

remains in safety at the bottom—the fox takes possession of the hole quitted by the badger, or forces it from the retreat by wiles—surprised by the dogs at a distance from its hole, it fights with desperate resolution—all that has life is its food—it sleeps the greatest part of the time, and, though not voracious, keeps fat, particularly in winter—it keeps the hole very clear—the female makes a bed of hay for her young—brings forth in summer, three or four young—how she feeds them—the young are easily tamed—the old are savage and incorrigible—are fond of fire, and often burn themselves dangerously—are subject to the mange, and have a gland under the tail, which scents strongly—its flesh rank and ill tasted, iii. 391, &c.

Bait, the best for all kind of fish is fresh herring—the larger sort will take a living small fish upon the hook sooner than any other bait, v. 82.

Balance, to determine the specific gravity of metals, i. 159.

Balearic-crane, its description—the real crane of Pliny—comes from the coast of Africa and Cape de Verd islands—its habits—has been described by the name of sea-peacock—foreign birds of the crane kind described, the jabiru, the jabiru-guacu, the anhima, and the buffoon bird, iv. 303, &c.

Ball of fire of the bigness of a bomb—its effects, i. 325.

Baltic, the Danes in possession of it, i. 195.

Banana, the elephant eats this plant to the roots, iii. 338.

Banks of a river, after inundations, appear above water, when all the adjacent valley is overflown, and why, i. 169.

Barb, an Arabian horse bred in Barbary, ii. 183.

Barbary-hen, its description, iv. 148.

Barble, a flat fish, its growth, v. 149.

Barbs of the whale, or whale-bone, v. 35.

Barnacle, imaginary, a shell-fish, v. 250.

Baroch, in the kingdom of Cambaya, flocks of peacocks seen in the fields near that city, iv. 136.

Barometer, serviceable in measuring the heights of mountains, i. 128—measures the weight of the air—in what manner, 252—changes in the air without sensible alteration in the barometer, 253—when it marks a peculiar lightness in the air, no wonder that it foretells a storm, and why, 291.

Barrettiere, a famous youth, considered as a prodigy of learning at the age of fourteen, slept regularly twelve hours in the twenty-four, ii. 13.

Basilisk, a kind of lizard, v. 324.

Bat, as big as a rabbit, i. 350—by some reckoned among birds, ii. 149—doubtful among naturalists whether beast or bird—now universally take place among quadrupeds—Pliny, Gesner, and Aldrovandus placed it among birds—scarcely in any particular resembles the bird, except the power of sustaining itself in the air—description of the common sort in

INDEX.

England—its intestines and skeleton, in some measure, resemble those of mankind—makes its first appearance early in summer, and begins its flight in the evening—is seen to skim along the surface of waters—feeds upon gnats, moths, and nocturnal insects of every kind, which it pursues open mouthed—its flight laborious, irregular, and, if interrupted, not readily followed by a second elevation—usually taken, when striking against an object it falls to the ground—even in the summer, it sleeps the greatest part of the time—its retreat—continues in a torpid state during winter—is usually hanging by its hooked claws to the roofs of caves, unaffected by all changes of weather—is destroyed particularly by the owl—the bat couples and brings forth in summer from two to five young at a time—the female has two nipples forward on the breast, as in the human kind, and this a motive for Linnæus to give it the title of a primas, to rank it in the same order with mankind—the female makes no nest for her young—when she begins to grow hungry, and finds a necessity of stirring abroad, she takes her little ones and sticks them by their hooks against the sides of her apartment, and there they immoveably cling, and patiently wait her return—less similitude to the race of birds than of quadrupeds—great labour in flying soon fatigues, and tires it in less than an hour—its petty thefts upon the fat of bacon—long-eared bat—horse-shoe bat—rhinoceros-bat—a larger race of bats in the East and West-Indies truly formidable—a dangerous enemy—when united in flocks they become dreadful—they are eat—the negroes of the African coasts will not eat them, though starving—on the African coast they fly in such numbers as to obscure the setting sun—the rousette, or great bat of Madagascar, is found along the coasts of Africa and Malabar, where it is often seen about the size of a large hen—destroys the ripe fruits, and sometimes settles upon animals, and man himself—destroys fowls and domestic animals, unless preserved with the utmost care, and often fastens upon the inhabitants, attacks them in the face, and makes terrible wounds—the ancients have taken their idea of harpies from these fierce and voracious creatures, equally deformed, greedy, uncleanly, and cruel—the bat, called the American vampyre—its decription by Ulloa—purport of his account confirmed by various travellers, who all agree that it has a faculty of drawing blood from persons sleeping, and destroying them before they awake—a strong difficulty remains how they make the wound—Ulloa and Buffon's opinions, suppose the animal endowed with a strong power of suction; and that, without inflicting any wound, by continuing to draw it enlarges the pores of the skin, so that the blood at length passes—they are one of the great

...ests of South America, iii. 225.——Found in the holes deserted by the wood-pecker, iv. 194.

Bath, persons coming out of a warm bath several ounces heavier than they went in—warm bath of sea-water a kind of relief to mariners upon a failure of fresh water at sea, i. 199.

To bay, said of a stag when he turns his head against the hounds, ii. 312.

Beagle. See *Hound*, iii, 12, 14.

Beak, how that of animals is produced, i. 423.

Beam, by hunters meant that part which bears the antlers, ii. 311.

Beams, those of the sun shining upon the fire, put it out, and why—darting directly upon us, without the medium of the air, would burn us up at once, or blind us with effulgence, i. 276.

Beards, Americans take great pains to pluck theirs up by the roots, the under part, and all but the whiskers, therefore supposed to have no hair growing on that part—Linnæus himself has fallen into this mistake—different customs of men, in the manner of wearing their beards, i. 420.

Bears, in cold frozen regions of the North not smaller than in milder countries, i. 350—the North American Indians anoint their skins with fat of bears, ii. 90.——The bears now and then make depredations upon the rein-deer, 356—in Greenland do not change colour, iii. 78—the black of America does not reject animal food, as believed—places where they are found—retreat of the brown bear—a vulgar error, that, during winter, the brown bear lives by sucking its paws; it seems rather to subsist then upon the exuberance of its former flesh—the male and female do not inhabit the same den, and seldom are seen together, but upon the accesses of genial desire—care of the female for her young—the bear, when tamed, seems gentle and placid; yet still to be distrusted, and managed with caution, being often treacherous and resentful without a cause—is capable of a degree of instruction—when come to maturity, can never be tamed—methods of taking them—their paws and hams a great delicacy—the white, placed in the coldest climates, grows larger than in the temperate zones, and remains master of the icy mountains in Spitzbergen and Greenland—unable to retreat, when attacked with fire-arms, they make a fierce and long resistance—they live upon fish and seals, their flesh is too strong for food—are often seen on ice-floats, several leagues at sea, though bad swimmers—the white sometimes jumps into a Greenlander's boat, and if it does not overset it, sits down calmly, and, like a passenger, suffers itself to be rowed along—hunger makes it swim after fish—often a

battle ensues between a bear and a morse, or a whale, and the latter generally proves victorious, iii. 385, &c.

Beasts are most fierce and cruel in all countries where men are most barbarous, ii. 162.

Beasts of chace, in the reigns of William Rufus, and Henry the First, it was less criminal to destroy one of the human species than a beast of chace—sacred edifices thrown down, and turned to waste, to make room for beasts of chace, ii. 309.

Beasts of prey seldom devour each other—they chiefly seek after the deer or the goat—their usual method of hunting, ii. 155.

Beaver, known to build like an architect, and rule like a citizen, ii. 160—Its fore parts taste like flesh, and the hinder like the fish it feeds on, 375——A remaining monument of brutal society—its qualities, taken from its fellows, and kept in solitude or domestic tameness—resists only when driven to extremity, and fights when its speed cannot avail—the only quadruped that has a flat broad tail, covered with scales, serving as a rudder to direct its motions in the water—the sole quadruped with membranes between the toes on the hind feet, and none on the fore feet—the only animal in its fore parts entirely resembling a quadruped, and in its hinder parts approaches the nature of fishes, having a scaly tail—its description—has but one vent for the emiſſion of excrements and urine—they assemble about the months of June and July—make a society to continue the greatest part of the year—form a company of above two hundred—fix their abode by the side of a lake or river—cut with their teeth a tree thicker than a man's body—amazing work and mansion houses—convey their materials by water—mix clay and dry grass together, work it into a mortar, and with their tails plaister their work within and without—their walls perpendicular, and two feet thick—their piers fourscore or an hundred feet long, and ten or twelve feet thick at the base—their dikes ten and twelve feet thick at the foundation—their apartments round or oval, and divided into three stories, one above the other—visited too often by men, they work only in the night-time, or abandon the place, and seek a safer situation—four hundred reside in one mansion-house, divided into a number of apartments, having communication with each other—their works in the northern parts finished in August or September—in summer they are epicures—their provisons for the winter season—they drive piles into the earth, to fence and fortify their habitation against the wind and water—cut down branches from three to ten feet in length—the largest are conveyed to the magazines by a whole body—the smallest by one only—each taking a different way, and having a walk aſſigned him, that no one ſhould interrupt another in his work—wood-yards larger or smaller, in proportion to the number in family—manner of catching them in snares, or by surprize—they swim with their mortar on their tails, and their stakes between their teeth—their works

damaged by force of water, or feet of huntsmen, instantly repaired, iii. 244, &c.

Beauty, every country has peculiar ideas of beauty—extraordinary tastes for beauty—every nation, how barbarous soever, has peculiar arts of heightening beauty—several of these arts, i. 404—a modern lady's face formed exactly like the Venus of Medicis, or the Sleeping Vestal, would scarcely be considered as a beauty, except by the lovers of antiquity—less in the object than in the eye of the beholder—superior beauty of our ancestors not easily comparable, ii. 112.

Beccafigo, a bird of the sparrow kind, iv. 247.

Bed of a river, an increase of water there increases its rapidity, except in cases of inundation, and why—such bed left dry for some hours by a violent storm blowing directly against the stream, i. 173.

Beds, the earth every where in beds over beds, and each of them maintaining exactly the same thickness, i. 51.

Bee, a ruminating insect, or seemingly so—its stomach is composed of muscular fibres, ii. 221.——Operations studied for two thousand years are still incompletely known—Reaumur's account sufficiently wonderful—many of the facts held dubious by those conversant with the subject—some declared not to have existence in nature—three different kinds of bees—common working bees neither male nor female—queen bees lay all the eggs that are hatched in a season—structure of the working bee, particularly of its trunk, which extracts the honey from flowers—manner of building their cells—in one day, they make cells upon each other enough to contain three thousand bees—description of those cells—the combs made by insensible degrees, not at once, as some imagine—the cells for the young and for the drones—that for the queen-bee the largest of all—those for honey are deeper than the rest—that not the only food upon which they subsist—manner of anticipating the progress of vegetation—the bee has a stomach for wax as well as honey—bee-bread—treacle for food of bees in winter—what part of the flower has the honey—sting of the bee—any wanting food, bends down its trunk to the bee from whom it is expected; which then opens its honey-bag, and lets some drops fall into the other's mouth—numerous as the multitude of bees appear in a swarm, they all owe their origin to one parent, called the queen bee—opening the body of a queen, the eggs at one time found to amount to five thousand—the queen easily distinguished from the rest—great fertility of the queen, and the great attentions paid to her, controverted by recent observers—they leave a cell to every egg, and destroy the rest—great care and affection for the young in about twenty days after the egg was laid, the bee was completely formed, and fitted to undergo the fatigues of its state—the cell being prepared, the animal soon transformed into

an aurelia, different from that of the common caterpillar—when they begin to break their prisons, above a hundred are excluded in one day—dreadful battles often ensue between the young brood and their progenitors—signs previous to their migrations—after the migration, the queen being settled, the swarm follows, and in a quarter of an hour the whole body is at ease—sometimes sacrifice their queen; but never when the hive is full of wax and honey—the working sort kill the drones in the worm state, in the cell, and eject their bodies from the hive among the general carnage—upwards of forty thousand bees found in a single hive—instances of expedition in working—in the first fifteen days, they make more wax than during the rest of the year—a hive sending out several swarms in the year, the first always the best and most numerous—a kind of floating bee-house used in France, vi. 92.

Bees in other countries—in Guadaloupe are less by half than in Europe, and have no sting—sometimes there are two or three queens to a swarm; then the weaker deserted for the more powerful protector—the deserted queen does not survive the defeat, is destroyed by the jealous rival; and till this be done, the bees never go out to work—at Guadaloupe their cells are in hollow trees, sometimes with a sort of waxen house, shaped like a pear, in which they lodge their honey, and lay their eggs—their honey never congeals, is fluid as oil, and has the colour of amber—in the tropical climates are black bees without a sting—their wax is soft, and only used for medicinal purposes, not being hard enough for candles, as in Europe—whether the humble-bees have a queen or not, there is one much larger than the rest, without wings, without hair, all over black, like polished ebony—this views all the works, from time to time—their habits—the honey gathered by the humble-bees neither so fi.., so good, nor the wax so clear, or so capable of fusion, as those of the common bees, vi. 111, &c.

Leaf-cutting Bees make their nest, and lay their eggs, among bits of leaves, vi. 114.

Wall-Bees, so called, because they make their nests in walls—the male and female are of a size—the former without a sting, vi. 114.

Wood-bee, vi. 112—*Mason-bee*, 113—*Ground-bee* build their nests in the earth—the patience and assiduity of their labour, 113.

Beetles, a ruminating insect, or seems to ruminate, ii. 221.——their general characteristics, vi. 142—their kinds distinguished from each other—description of the dorr-beetle, or the May-bug—how the two sexes in the May-bug are distinguished from each other—season of their coupling—the female bores a hole into the ground, where to deposit her burthen; and when lightened of it ascends from the hole, to live as before—their eggs—description of the insect, and its manner of life in the worm-state—continues in that state for more than

three years, changing every year its skin, and living under the ground without eyes—in what manner it assumes the form of a chrysalis—time when it becomes winged, and completely formed—the old one never survives the season—and dies from the severity of cold in winter—its habits and food, when completely formed—number of their eggs—rooks and hogs particularly fond of them, and devour them in great numbers—instances of great devastations made by the May-bug—description and habits of that beetle, which the Americans call the tumble-dung—the insect called king of the beetles—description of the elephant-beetle, the largest of this kind hitherto known, 143, &c.

Bell, the great diving-bell improved by doctor Halley—he could write or read in it when the sea was clear, and especially when the sun shone, i. 241.

Bell, when the stag cries, he is said to bell, ii. 311.

Bells, their vibrations not heard under the receiver of an air-pump, i. 277.

Berries, the Laplanders drink water, in which juniper-berries have been infused, ii. 74.

Bewailer, or the sai, a monkey of the new continent, iii. 315.

Bezoar, its description, ii. 280—German bezoar, ii. 274.

Bezoar-goat, the oriental bezoar, ii. 280—cow-bezoar, and monkey-bezoar—hog-bezoar, ii. 282.

Billitting, a name given by huntsmen to the excrement of the fox, iii. 47.

Birch, hares are particularly fond of it, iii. 121.

Bird-catchers, sport by counterfeiting the cry of the owl, iv. 113—nets for, and method of taking small birds, 238.

Birds, all produced from the egg, i. 365—their lower eye-lid alone has motion, 411—have the neck longer than any other kind of animals—those which have short claws, have also short necks—those that have long claws have the neck in proportion, 423——have a power of disgorging food to feed their young—ruminating birds, ii. 220—many kinds which the dog will not touch, iii. 28—hunters often informed by the birds of the place of retreat of the fox, 50—a flock of small birds often alarms every thicket, and directs the hunter to the martin, 90——surpass fishes and insects in structure of body, and in sagacity—their anatomy and conformation—compared to a ship making way through water—are furnished with a gland behind, containing a proper quantity of oil—to what purpose—description of their feathers, iv. 2, &c.—the pectoral muscles of quadrupeds trifling to those of birds—chuse to rise against the wind, and why—all, except the nocturnal have the head smaller, and less in proportion to the body, than quadrupeds—their sight exceeds most other animals, and excels in strength and precision—have no ex-

ternal ear standing out from the head—the feathers encompassing the ear-holes supply the defect of the exterior ear—the extreme delicacy of their sense of hearing, is easily proved by their readiness in learning tunes, or repeating words, and the exactness of their pronunciation—their delicacy in the sense of smelling—instance of it in ducks—the tail guides their flight like a rudder, and assists them either in the ascent or descent—wonderful internal conformation—the windpipe often makes many convolutions within the body of the bird, and is then called the labyrinth—of what use these convolutions are no naturalist has been able to account—this difference obtains in birds to all appearance of the same species—whence some derive that loud and various modulation in their warblings is not easily accounted for—birds have much louder voices, in respect to their bulk, than animals of other kinds—all have properly but one stomach, but different in different kinds—the organs of digestion in a manner reversed in birds—why they pick up sand, gravel, and other hard substances—most have two appendices or blind guts—in quadrupeds always found single—all birds want a bladder for urine—their urine differs from that of other animals—effects of the annual molting which birds suffer—their molting time artificially accelerated, and how—the manner in which nature performs the operation of molting—their molting season—many live with fidelity together for a length of time—when one dies the other shares the same fate soon after—the male of wild birds as happy in the young brood as the female—nothing exceeds their patience while hatching—Addison's observations to this purpose—great care and industry in providing subsistence for their young—they feed each of the young in turn, and why—perceiving their nests or young to have been handled, they abandon the place by night, and provide a more secure, though less commodious retreat—the young taught the art of providing for their subsistence—those hatched and sent out earliest in the season the most strong and vigorous, 7, &c.—they endeavour to produce early in the spring, and why—efforts for a progeny when their nests are robbed—such as would have laid but two or three eggs, if their eggs be stolen will lay ten or twelve—the greatest number remain in the districts where they have been bred; and are excited to migration only by fear, climate, or hunger—cause of the annual emigrations of birds—times of migrations—in what order performed—follow the weather rather than the country, and go on as they perceive the atmosphere more suitable to their wants and dispositions—in all countries, longer lived than quadrupeds or insects of the same climate—surprising age of swans and geese—plumage and voice of birds in different zones—all less than quadrupeds—the greatest of one class surpass the greatest of the other in magnitude—causes of the great

variety in the middle order of birds—the ostrich is the greatest of birds—the humming-bird the smallest—wild birds generally of the same magnitude and shape—inferior to quadrupeds in docility—difference between land-birds and water-fowls, 23, &c.—description of birds of the rapacious kind—the pie kind—the poultry kind—the sparrow kind—the duck kind—the crane kind, 33—the nauseous bird, or dodo, 58—powers of land-birds of the rapacious kind to obtain their food—sight of such as prey by day surprisingly quick—such as ravage by night have their sight fitted to see in darkness with precision—inhabit the most lonely places and desert mountains—appearing in cultivated plains, or the warbling groves, is for depredation—every order of carnivorous birds seek for those of the size approaching their own—the carnivorous kinds only breed annually, and are less fruitful than others—breed but few at a time—where supplies of food are difficult, the old soon drive the brood from the nest to shift for themselves, and often destroy them in a fury, caused by hunger—almost all birds of prey unsociable—the male and female when necessary to each other live together; but they most usually prowl alone—birds with crooked beaks and talons are solitary—all males of prey are less, and weaker than females—the females are of a greater size, more beautiful and lovely for shape and colours, stronger, more fierce, and generous, than the males—it may be necessary to be thus superior, to provide for herself and her young—these birds are lean and meagre—their flesh is stringy and ill-tasted, soon corrupting, and flavoured of that animal upon which they subsist—Belonius asserts, many people like the flesh of the vulture and falcon, and dress them for eating; and that the osprey, when young, is excellent food—five kinds of land-bird, of a rapacious nature—whence their distinctive mark, 60, &c.—bird of heaven, name given by the ancients to the eagle, 67—the most formidable birds of prey respect the butcher-bird, 102—the digestion of such as live upon mice, lizards, or the like food, not very perfect, 110—father Kircher set the voices of birds to music, 111—domestic birds of the poultry kind, maintained in our yards, are of foreign extraction, 119—the wilder species cooped or caged, pine away, grow gloomy, and some refuse all sustenance—the poultry kind alone grow fat, 121—climate, food, and captivity, three very powerful agents in the alterations in the habits, and the very form of birds—of all birds the cock the oldest companion of mankind, and the first reclaimed from the forest, 123—also the Persian bird of Aristophanes, 124—description of the tamis, or the bird of Numidia, 148—the bustard the largest land-bird, native of Britain, 149—none secures its young better from external injury than the toucan, 190—God's bird, the bird of paradise, 202—parakeets the most beautiful in plu-

mage, and the most talkative birds in nature, 221—the pigeon, for its size, has the largest crop, 226—small birds mark out a territory to themselves, which they permit none of their own species to remain in—at some season of the year, all small birds migrate from one country to another, or from more inland provinces towards the shore—months of their migrations—Autumn the principal season for catching these wanderers—the nets and the method of catching them—slur-birds—singing among birds universally the prerogative of the male—small birds fight till one yields his life with the victory—two male birds strive in song, till the loudest silences the other; during the contention, the female sits an attentive silent auditor, and often rewards the loudest songster with her company during the season—the male, while his mate is hatching, sits upon some neighbouring tree, to watch and to sing—the nests of small birds warmer than of the larger—small birds having finished their nests, nothing exceeds the cunning they employ to conceal it—worms and insects the first food of all birds of the sparrow kind—how birds of the sparrow kind bring forth and hatch their young—manner of life during the rigours of winter—the male of small birds not finding a mate of his own species, flies to one of another, like him, left out in pairing—a mixed species between a goldfinch and a canary bird, between a linnet and a lark, these breed frequently together, and produce, not like the mules among quadrupeds, a race incapable of breeding again, but one as fruitful as their parents—various birds of the sparrow kind—many plants propagated from the depositions of birds—many of those kinds which are of passage in England, permanent in other countries; and some, with us constant residents, in other kingdoms have the nature of birds of passage—instances of it, 237, &c. the heron commits the greatest devastation in fresh waters, 310—the flamingo has the largest tongue, 326—birds of various sorts and sizes more than the stars in a serene night, seen in the rock of the Bass, in the Firth of Forth, 369—none make a more indifferent figure upon land, or a more beautiful in the water, than the swan, 399—of all birds known, it is the longest in the shell, 107—an incontestible proof that birds have their manners rather from nature than education, 409.

Biscayneers, were in possession of the whale-fishery on the coasts of Greenland, in the beginning of the fourteenth century, v. 42—their method of taking the whale, 43.

Bison and *Urus*, names of descendants of one common stock—error of the naturalists upon this point—the cow and bison are animals of the same kind—description of the bison—it is supposed by Klein and Buffon no more than another name for the bonasus—the breed found in all the southern parts of the world—that breed more expert and docile than

ours—many bend their knees to take burdens up or set them down—the respect for them in India degenerated into adoration—it is nimble of foot—is esteemed by the Hottentots—assists them in attending their flocks, and guarding them against invaders—is taught to combat the enemies of the nation, and every army of the Hottentots is furnished with a herd of them—they procure the Hottentots an easy victory before they strike a blow—lives in the same cottage with its master, and when it dies, a new one is chosen to succeed it by a council of the old men of the village, and is then joined with a veteran of its own kind, from whom it learns, becomes social and diligent, and is taken for life into friendship and protection—the bisons are found to differ from each other in several parts of the world—some have horns, some are without—they are equally tractable and gentle when tamed—and are furnished with a fine, lustrous, soft hair, more beautiful than that of our own breed—their hump of different sizes, weighing from forty to fifty pounds, more or less—cuts and tastes somewhat like a dressed udder—the bisons of Malabar, Abyssinia, Madagascar, Arabia, Africa, and America—in the course of a few generations, the hump wears away—its description—the bison and the cow breed among each other—the grunting or Siberian cow, and the little African cow or zebu, are different races of the bison, ii. 228, &c.

Bitch, a pregnant bitch, so placed by Mr. Buffon, that her puppies were brought forth in warm water, i. 386.

Bitches, one forgotten in a country-house, lived forty days without any other nourishment than the wool of a quilt she had torn to pieces, iii. 28.

Bittern, or mire-drum, the solemnity of its evening-call cannot be described by words—they are calls to courtship, or of connubial felicity—it differs from the heron chiefly in colour—its windpipe fitted for the sound—opinions concerning the cause of its boomings—never utters its call in domestic captivity—its residence— a retired timorous animal—its food, nest, and eggs—in three days, leads its little ones to their food—differences between the bittern and the heron—its hollow boom considered by the vulgar as the presage of some sad event—instance of it—its flesh greatly esteemed among the luxurious—it seldom rises but when almost trod upon—at the latter end of autumn, in the evening, its wonted indolence forsakes it—is then seen rising in a spiral ascent, till quite lost from the view, making a singular noise, different from its former boomings—names given to this bird by the Greeks and Latins, iv. 316.

Bivalve shells, v. 209—all the kinds hermaphrodite, yet require no assistance towards impregnation, 232—particularly in these shell-fish the pearls are found, 242.

Black-bird, of the sparrow-kind, iv. 246—sometimes seen all over white—its eggs and nest, 251.

Black-cap, bird of the sparrow-kind, iv. 249—prized by some for its singing, and is also called the mock nightingale, 262.

Blacks, conjectural opinion that the blacks are a race of people bred from one man accidentally black—the climate a cause obvious and sufficient to produce blackness—nothing satisfactory discoverd upon the cause producing it in human complexions—opinion of Sir Thomas Brown upon the subject, ii. 87—whence originally their flat noses, 92—black parents have procreated two white negroes, 93.

Bladder, birds have no bladder for urine, iv. 13. See *Fishes*. v. 16, &c.

Blennius, or *Blenny*, description of this fish, v. 21, 123.

Blind, such as live in countries generally covered with snow become blind, ii. 30.——The mole not blind, iii. 190.

Blindworm, its description, v. 376.

Blood, arterial blood immediately mixed with air in the lungs, is of a fine florid scarlet colour—that of the veins returning to the heart is of a blackish crimson hue—whence this difference of colour proceeds not well understood, i. 275.——The blood circulates through the bones, as through every other part of the body—Mr. Belcher the first who discovered it—his experiment to this purpose, ii. 57.——Blood of the rein-deer preserved in small casks for sauce with the marrow in spring, ii. 354.——The heat of the blood in man and other animals about thirty degrees above congelation—in the marmout, and other animals which sleep the winter, it is not above ten degrees, iii. 152.

Blood-hound, described, iii. 14.

Blue-bird, described—its residence—is rarely caught—its docility—speaks and whistles at the word of command—manner of taking it, iv. 252.

Blue-cat, described, ii. 390.

Blushing, whence it proceeds, i. 417.

Boar, wild, varies not his colour as hogs of the domestic kind—description—he plows the ground like a furrow—his tusks seen almost a foot long—they differ from those of the elephant in that they never fall—when the boars come to a state of maturity, they dread no single creature—their position when attacked—the manner of hunting them—when killed, the testicles cut off to prevent their tainting the flesh—was formerly a native of our country—William the Conqueror punished with the loss of their eyes such as killed it in his forests—at present the wild breed is extinct, ii. 358, &c.—the Canary-boar described—the tusks being broken away, the animal abates its fierceness and venery, and nearly the same effect as castration is produced, 379—does not

fly the approach of the lion—combat of a lion and a wild boar, in a meadow near Algiers, 402.
Bobak, name of the marmout in Poland, iii. 155.
Bodies, why some light bodies swim, and ponderous bodies sink, i. 158—the deeper a body sinks, the greater the resistance of the depressed fluid beneath—how then, after it is got a certain way, does it sink at all, 160—animal bodies left to putrify, produce air copiously, 279.——Symmetry of the human body—the body of a well-shaped man ought to be square, 406—human body often found to differ from itself in size—instance of it—the cause—differs also from itself in weight—instances of it, 428—those parts furnished with the greatest quantity of nerves, are first in formation, ii. 20—the tone of a sonorous body made to depend upon the number of its vibrations, and not the force, is taking an effect for a cause, 34—suffering is but to a certain degree—torture becoming excessive, destroys itself; and the mind ceases to perceive, when the body can no longer endure, 68.
Boerhaave observed to his pupils little ridges of hills in Holland, as mountains of no small consideration, i. 115—says, if we filter and distil water a thousand times it will depose a sediment, 141—considered heat so prejudicial to health, that he was never seen to go near a fire, 269.——His conjectures of the cause of hunger, ii. 5.——Said upon poisons, to teach the arts of cruelty is equivalent to committing them, iv. 127.
Boiguacu, the largest of the serpent kind in South America—sometimes forty feet in length, i. 350.——Description of this creature, v. 379.
Bonasus, supposed by Klein and Buffon another name for the bison, ii. 232.
Bones, in the embryo, soft almost as the muscles and flesh—hard as the bones seem, the blood holds its current through them, as through other parts of the body—in old age more solid, also more brittle, and why, ii. 57, &c.——Fossile bones found on the banks of the Ohio, in Peru, and Brasil, iii. 356.
Bonet-chinois, Mr. Buffon's name of a monkey, supposed a variety of that called malbrouk, iii. 313.
Bonito, description of this fish, v. 129.
Booby, name given by our seamen to birds of the penguin tribe, iv. 387.
Borandians, description of them, ii. 72.
Boristhenes, or Nieper, a river, its course and source, i. 175.
Borneo, island in the East Indies, where the barbyrouessa, or Indian hog, is principally found—hog of Borneo, the name given by travellers to the babyrouessa, ii. 376.
Borneo, the natives hunt the ourang-outang in the same manner as the elephant or the lion, iii. 288.

Bosphorus, (the Thracian) was the first appropriated, by granting to such as were in possession of its shore the right of fishing in it, i. 195.

Bottom of the sea in some parts not found, and why—that of the Red Sea, a forest of submarine plants—that of the sea near America covered with vegetables—a map of the bottom of the sea between Africa and America, by M. Buache, i. 234, &c.

Bowels of the ruminating animals considered as an elaboratory with vessels in it, ii. 218.

Boyuna, of Ceylon, a kind of serpent, v. 377.

Brain and spinal marrow the first seen in the embryo, ii. 20. ——Earth-worm entirely without it, vi. 174—some animals live without their brain for weeks, 176.

Brambling, bird of the sparrow kind, iv. 247, 248.

Bramins of India, have a power of smelling equal to most creatures—they smell the water they drink though to us quite inodorous, ii. 46—have erected hospitals for the maintenance of all kinds of vermin, 81——also for such monkies as are sick or disabled, iii. 313.

Brasil, black clothes worn there soon turn of an iron-colour—kept in the shop, preserve their proper hue, i. 259——duck described, iv. 412.

Bread, twelve ounces of it, and nothing but water, the common allowance for four-and-twenty hours, among the primitive Christians of the East, ii. 8—that of the Laplanders composed of bones of fishes, pounded and mixed with the inside tender bark of the pine-tree, 74.

Bream, description of the sea-bream, v. 124.

Breasts in women larger than in men—milk found in breasts of men as well as of women, i. 424—black women's breasts, after bearing one child, hang down below the navel—it is customary among them to suckle the child at their backs, throwing the breast over the shoulder, ii. 83.

Breath of the lion is very offensive, ii. 401.—manner of breathing in fishes, v. 10.

Breeze, constant breeze produced by the melting of snows, i. 286—from sea increases gradually till twelve, sinks away, and totally hushed at five—upon its ceasing, the land-breeze begins, increases till twelve at night, and is succeeded in the morning by the sea-breeze—cause of these two breezes—sometimes these sea and land-breezes come at all hours—the land and sea-breezes on the coasts of Malabar and at Congo, 287.

Breeze, or gad-fly, an insect that annoys cattle in the summer, vi. 164.

Brisson, his method of classing animals, ii. 137.

Bristol, a citizen of it who ruminated his food, ii. 221.

Britons, the ancient, considered the hare as an unclean animal, and religiously abstained from it, iii. 126—the cock a forbidden food among them, iv. 124.

Broches, the horns of the stag the first year, ii. 311.

Brock, the stag of the third year, ii. 311.

Brown (Sir Thomas) hoped one day to produce children by the same method as trees, i. 365—his opinion upon the cause of blackness in human complexions, ii. 89.

Brun (Le) giving a painter directions about the passions, places the principal expression of the face in the eye-brows, i. 410.

Brush, the name given by huntsmen to the tail of the fox, iii. 47.

Brutes, in those countries where men are most barbarous and stupid, brutes are most active and sagacious, iii. 311.

Buache (Mr.) has given a map of the bottom of the sea between Africa and America, i. 241.

Bubalus, an animal partaking of the mixed natures of the cow, the goat, and the deer—its description—has often been called the Barbary cow, from which it differs widely, ii. 284, &c.

Bubalus, properly a gazele of Africa, ii. 340.

Bubalus, of the ancients, supposed of the cow kind by Buffon, placed among the lower class of ruminant quadrupeds, ii. 232.

Buccinums, one or two of them viviparous, v. 223.

Buck, capable of propagating at the age of one year—one buck sufficient for an hundred and fifty goats—becomes old before his seventh year, ii. 263—hunting the buck and the stag performed in the same manner in England, 310—number of names invented by hunters for this animal—does not change his layer, like the stag—manner of hunting him is much the same as that of stag-hunting, 323.

Buck-goat produces with the ewe an animal that, in two or three generations, returns to the sheep, retaining no mark of its ancient progenitor, ii. 247.

Buffalo, of the varieties of the cow-kind, but two are really distinct, the cow and the buffalo—they bear an antipathy to each other—they do not breed among each other, and no animals are more distinct and like each other less—are in abundance in Guinea and Malabar—it is a great swimmer—description of it—the veal of the young is not better eating than the beef of the old—they are natives of the warmer climates—yet are bred in several parts of Europe, particularly in Italy—the female produces one at a time—continues pregnant for twelve months—is afraid of fire—leather made of its hide is well known for thickness, softness, and impenetrability—guided by a ring thrust through its nose—milk of the

female not so good as of the cow—two buffaloes yoked draw more than four strong horses—its flesh hard and blackish, disagreeable to taste and smell—this animal wild in many parts of India, and dangerous—manner of hunting them—when tamed, no animal more patient or humble—inferior in size only to the elephant, the rhinoceros, or hippopotamos—the camelopard, or camel, if taller, neither so long, nor so corpulent—is fond of the water, and crosses the largest rivers without difficulty—has an aversion to red colours that resemble flame—in those countries where they are in plenty no person dresses in scarlet—they make most use of their feet in combat, and rather tread their enemies to death than gore them, ii. 238, &c.

Buffon, (M.) his theory of the earth, and a detail of it—questions that might be afked this most ingenious philosopher concerning his theory of the earth, i. 26.—he has brought together a multitude of facts relative to the history of the earth, 36—his system about the rudiments of animals, 359—objections against it, 360—thinks that women never become bald, 411—his description of the first sensations of a man just brought into existence, pointing out the steps by which he arrived at reality, ii. 52.

Buffoon-bird, name our sailors give the Numidian crane—its peculiar gestures and contortions—the French call it demoiselle—it is a very scarce bird—the ancients have described a buffoon-bird, but not meant the Numidian crane, iv. 307, &c.

Bug, the May-bug. See *Beetles*.

Bugs, their habits—described—are often found coupling tail to tail—manner of destroying them—they destroy fleas, and devour each other, v. 422.

Bulbous, hair is so at the root, i. 412.

Bull, the gimerro, afferted to be between the ass and the bull, ii. 207.

Bull-dog, described, iii. 17.

Bullfinch, bird of the sparrow kind, iv. 247—may be taught to whistle a regular tune, 270.

Bull-Head, description of this fish, v. 125.

Bulls, the wild, in Spain, mean, despicable animals—have nothing of that sternness of aspect remarkable in our bulls, ii. 233.

Bull's-eye, name given by sailors to a terrible hurricane—described, i. 297.

Bunting, bird of the sparrow kind, iv. 247.

Burnet, his theory of the earth—a detail of that work, i. 17, 18.

Buftard, the largest land-bird that is a native of Britain—inhabits the open and extenfive plain—is much larger than the turkey, the male generally weighing from twenty-five to twenty-seven pounds—its description—its food—places where frequently seen in flocks of fifty or more—they have always

centinels placed at proper eminences, ever on the watch, to warn the flock of the appearance of danger—are often run down by greyhounds—in what manner—seldom wander above twenty or thirty miles from home—the males have a pouch, holding near seven quarts of water—they change their mates at the season of incubation, about the latter end of summer—separate in pairs, if there be a sufficiency of females for the males; otherwise the males fight until one of them falls—in France, some of those victims of gallantry found dead in the fields—their nests—they lay two eggs, almost the fize of a goose-egg—hatch for about five weeks—the young run about as soon as out of the shell—they assemble in flocks in October, and keep together till April—their food in winter—in parts of Switzerland they are found frozen in the fields in severe weather—when taken to a warm place, they again recover—usually live fifteen years, and are incapable of being propagated in a domestic state, iv. 149.

Butcher-bird, its description, with its habits—leads a life of continual combat—intrepidity of this little creature, in going to war with the pie, the crow, and the kestril, all above four times bigger than itself—it fights upon the defenfive, and often comes to the attack with advantage, particularly when the male and female unite to protect their young, and to drive away the more powerful birds of rapine—in what manner they sally forth against them—sometimes the combat ends with the destruction of the assailant, and also of the defender—the most redoubtable birds of prey respect them, and they fly in their company without fearing their power, or avoiding their resentment—small birds are its usual food; and when it has killed the bird or insect, as asserted by the best authority, it fixes them upon some neighbouring thorn, and when thus spitted, pulls them to pieces with its bill—the smaller red butcher-bird migrates—the places where they are to be found—their nests, and the number of their eggs—the female feeds her young with caterpillars and other insects, but soon after accustoms them to flesh, procured by the male with great industry—their nature very different from other birds of prey in their parental care; for, instead of driving out their young from the nest to shift for themselves, they keep them with care, and even when adult do not forsake them—the whole brood thus live in a family together—each family afterwards live apart, and hunt in concert—upon the returning season of courtship, this union is at an end, the family parts for ever, each to establish a little household of its own—the manner of flying is always up and down, seldom direct or fideways—different kinds of this bird, iv. 102.

Butter, the fat of the manati serves in all cases instead of butter, iii. 270.

Butterfly, some kinds actually live upon nothing, ii. 3.—— one of

the principal ornaments of oriental poetry—in those countries, the insect is larger and more beautiful than with us, vi. 45.—eafily distinguished from flies of every other kind by their wings—number and beautiful colours of its wings—butterflies can discover their mates at more than a mile distance—description of the head, corselet, and body—the eyes have not all the same form; but the outward coat has a lustre, in which may be discovered all the colours of the rainbow—when examined closely, it has the appearance of a multiplying glass—the use of their horns or feelers as yet unknown—use of their trunks—difference between butterflies and moths—they often perceive the approach of the female at above two miles distance; by what sense is not easy to conceive—it has no organs for smelling—the female is larger than the male—if disturbed while united, the female flies off with the male on her back, entirely paffive upon the occafion—after junction, they depofit their eggs and die—all females of this tribe are impregnated by the male by one aperture, and lay their eggs by another—every butterfly chuses for her brood, instead of the plant most grateful in its winged state, that it has fed upon in its reptile form—how they keep their eggs warm, and also entirely concealed—many do not lay till the winter warns them of their approaching end—some continue the whole winter in hollows of trees, and do not provide for posterity until the beginning of April, then leave their retreats, depofit their eggs, and die, vi. 67.

Buzzard, a sluggish inactive bird, often remains perched whole days upon the same bough—lives more upon frogs, mice, and insects, than upon birds, more troublesome to seize—its manner of living in summer—so little capable of instruction, that it is a proverb to call one obstinately ignorant, a buzzard—the honey-buzzard, the moor-buzzard, and the hen-harrier, are of this stupid tribe, and differ chiefly in their size, iv. 99.

Byron (Commodore) our laft voyager that has seen the gigantic race of mankind, ii. 109.

C.

Cab'ai, the same animal as the Capibara, ii. 373.

Cachalot, a fish, said to pursue a shoal of herrings, and to swallow thousands at a gulp, v. 13—it has generally gone under the name of the spermaceti whale, till Mr. Pennant made the distinction, borrowing its name from the French—description—the throat of this animal very formidable—with ease it could swallow an ox—it can at one gulp send a shoal of fishes down its enormous gullet—it terrifies the dolphins and porpoises so much, as often to drive them on shore—it contains two precious drugs, spermaceti and ambergris—the oil of this fish is

easily convertible into spermaceti, by boiling it with a ley of pot-ash, and hardening it in the manner of soap—candles are now made of it—the balls of ambergris not found in all fishes of this kind, but chiefly in the oldest and strongest, 50, &c.
Cagui, or the saki, is the largest monkey of the sagoin kind—its description, iii. 316.
Cajeta, a mountain near it was split by an earthquake, i. 131.
Cairo, in what manner they produce there six or seven thousand chickens at a time, iv. 130.
Caius, (Dr.) lived in the time of Queen Elizabeth, wrote the Natural History of Dogs, and divides the whole race into three kinds, the generous, the farm-kind, and the mongrel, iii. 13.
Calao, the horned Indian raven, iv. 182.
Calcination, all animal substances, when calcined, are the same, v. 288.
Calf, name given to the young of the hind, or the female of the stag, ii. 307.
Calf, or hind-calf; the stag called so the first year, ii. 311.
Callitrix, the green monkey of St. Jago, of the ancient continent —its description, iii. 313.
Callyonymus, the dragonet—description of this fish, v. 123.
Calms attended with deluges of rain—why, and where, i. 297.
Camel, a ruminating animal, ii. 220—camel and dromedary, not two distinct kinds, only a variety of the same, which has subsisted time immemorial—the only sensible difference between those two races, they produce with each other, and the mixed breed is considered the best—of the two the dromedary is far the most numerous—countries where the camel and dromedary are found—neither can subsist, or propagate, in the climates towards the North—Arabia the most adapted to the support and production of this animal—the camel the most temperate of all animals—it can continue to travel several days without drinking, and is often six or seven days without any sustenance—its feet formed to travel upon sand, and utterly unfit for moist or marshy places—many vain efforts tried to propagate the camel in Spain—they have been transported into America, but have multiplied in neither—they might perhaps produce in these countries, but would in a few years degenerate; their strength and their patience would forsake them; and, instead of enriching, become a burthen to their keepers—uses to which this animal is put among the Arabians—its education—it has a fifth stomach, as a reservoir, to hold a greater quantity of water than immediately wanted—when the camel finds itself pressed with thirst, it throws up a quantity of this water, by a simple contraction of the muscles, into the other stomachs—travellers, when straitened for water, have often killed their camels for what they expected to find within them—countries where commerce

is carried on by means of camels—trading journies in caravans—their food—pursue their way when the guides are utterly astray— its patience and docility when loaded—in what manner the female receives the male—one male left to wait on ten females, the rest castrated—they live from forty to fifty years—every part of this animal converted to some useful purpose—its very excrements are not useless—their burthen, iii. 371, &c.

Cameleon, its dimensions and appetites—has a power of driving the air it breathes over every part of the body—changes of its colour—it is an error that it assumes the colour of the object it approaches—description of it by Le Bruyn—it often moves one eye, when the other is at rest—sometimes one eye seems to look directly forward, while the other looks backward; and one looks upward, while the other regards the earth, v. 315.

Camelopard described—dimensions of a young one—inhabits the deserts of Africa—no animal, from its disposition, or its formation, less fitted for a state of natural hostility—it lives entirely upon vegetables—known to the ancients, but rarely seen in Europe—often seen tame at Grand Cairo in Egypt—Pompey exhibited at one time ten upon the theatre, iii. 367.

Camblet made of the hair of animals about Angora, ii. 265.

Canada, above thirty thousand martins skins annually imported from that county into England, iii. 91.

Canals for the circulation of blood through the bones—are of different capacities, during the different stages of life, ii. 58—canal of communication through which the blood circulates in the fœtus, without going through the lungs, found open in some bodies when dissected, 246.

Canary-bird, taught to pick up the letters of the alphabet at the word of command, to spell any person's name in company, iv. 31—by the name, originally from the Canary Islands—come to us from Germany, where they are bred in numbers—at what period brought into Europe is not known—about a century ago they were sold at very high prices, and kept only for the amusement of the great—in its native islands it is of a dusky grey colour, and so different from those seen in Europe, as to raise a doubt about its species—rules and instructions for breeding them in a domestic state—apparatus for breeding it in Germany—food the old ones must be supplied with, when the young ones are excluded—so prolific are these birds sometimes, that the female will be ready to hatch a second brood, before the first is able to quit the nest—this bird kept in company with the linnet or gold-finch, pairs, and produces a mixed breed, most like the canary-bird, and resembling it in its song, 265, &c.

Canary-boar described, ii. 379.

Cancerous breasts cured by the sucking of the rubeth, or the land-toad, v. 281.

Candle quickly extinguifhed in an exhausted receiver, and why, i. 276.

Cannons filled with water, and left to freeze, burst, i. 151.

Cantharis, well known in the shops by the name of Spanish flies, and for their use in blisters—their description, with the differences from each other—the countries where, and trees on which they are seen—it is reported, that the country people expect the return of these insects every seven years—their bad smell is a guide to those who catch them—they smell so disagreeable, as to be perceived at a great distance, especially about sun-set, though not seen at that time—they yield a deal of volatile caustic salt—their qualities—the effects fall principally upon the urinary passages—in what manner they are killed, vi. 152.

Cape de Verde ifland—a south wind prevails in them during the month of July, i. 286.

Cape of Good Hope, a north-west wind blows there during the month of September, i. 286—customary to hunt the elephant for its teeth—in what manner—account of an unhappy huntsman, v. 355.

Capibara, or cabiai, an animal resembling an hog of about two years old—its description—some naturalists have called it the water-hog; and why—a native of South America, and chiefly frequenting the borders of lakes and rivers—like the otter it seizes the fish, upon which it preys, with its hoofs and teeth—lives also upon fruits, corn, and sugar-canes—its cry resembles the braying of an ass, more than the grunting of a hog—its only place of safety is the water, into which it plunges when pursued, and keeps so long at the bottom, that the hunter can have no hopes of taking it there—when young is easily tamed—its flesh has a fishy taste, but its head is said to be excellent, ii. 373.

Capon of Pharaoh supposed the true ibis—is a devourer of serpents, and follows the caravans that go to Mecca, to feed upon the offal of the animals killed on the journey, iv. 303.

Capons taught to clutch a fresh brood of chickens throughout the year, iv. 130.

Caracal, or the syagush, a native of the East Indies, resembles the lynx in size, ii. 430.

Caraguata, a plant in the West Indies, which clings round the tree it happens to be near—it keeps away that nourishment designed to feed the trunk, and at last entirely destroys its supporter, i. 349.

Carapo, the gymnotus, description of this fish, v. 126.

Carassa, a volcano in South America, i. 84.

Caravan, a single lion of the desert often attacks an entire caravan, ii. 395——the assemblage called a caravan some-

times composed of numbers amounting to ten thousand, iii. 375.

Carcajou, name given by the North Americans to the glutton—its manner of killing the rein-deer, ii. 356.

Caribou, name the Americans give the glutton, ii. 356.

Carnivorous animals seek their food in gloomy solitude—they are sharper than the ruminating animals, and why—their stomachs small, and their intestines short, —their intestines thin and lean, ii. 217——except the dog, none will make a voluntary attack, but with the odds on their side—in proportion as each wants strength, it uses the assistance of patience, assiduity, and cunning—all animals of this kind pursue in a pack, and encourage each other by their mutual cries—support a state of famine for several weeks together, —milk in those animals is more sparing than in others, ii. 153.

Carnivorous birds seek for such as are of the size most approaching their own. See *Birds*, iv. 61.

Carp, an experiment made with this fish in a large vase of water, under an air-pump, v. 15—one found by Buffon not less than a hundred years old—this discovery confirmed by other authors, 20—continues in the egg not above three weeks, 23—Mr. Tull famous for his invention of spaying carp to give it a fine flavour, 25—its description, 129.—the method of fattening it in a damp cellar—it has been known thus to live for a fortnight, to grow exceedingly fat, and to get a superior flavour, 133.

Carriers, pigeons used to carry letters, iv. 229.

Carrion-crow, resembles the raven in its appetites, its laying, and manner of bringing up its young, iv. 173.

Carthagena, in America—the heat of the climate affects the speech of its inhabitants, which is soft and slow, and their words generally broken—more than three parts of our army destroyed by the climate, in our unsuccessful attack upon it, i. 266.

Cartilage, the thyroid cartilage, i. 424.——Cartilages in youth elastic, and pliant in age, become at last hard and bony; and why, ii. 59.

Cartilaginous fishes—their general conformation—supposed they grow larger every day till they die—their internal structure—are possessed of a two-fold power of breathing—apertures by which they breathe—the cartilaginous shark, or ray, live some hours after they are taken—fishes of this tribe can remain under water, without taking breath; and can venture their heads above the deep, and continue for hours out of their native element—little difference between the viviparous and the oviparous kinds, in this class of fishes—five divisions of the cartilaginous fish, v. 63.

Cassowary, a bird first brought into Europe by the Dutch from Java, in the East Indies, where only it is found—its description—the part which most distinguishes this animal is the head, which inspires some degree of terror—its internal parts described—it has the head of a warrior, the eye of a lion, the defence of a porcupine, and the swiftness of a courser—is not fierce in its natural character—how it defends itself—extraordinary manner of going—the Dutch assert that it can devour glass, iron, and stones, and even live and burning coals, without the smallest fear, or the least injury—the largest of its eggs is fifteen inches round one way, and twelve the other—places where this animal is found—it has not multiplied in any considerable degree, as a king of Java made a present of one to the Captain of a Dutch ship, as a rarity, iv. 51.

Catacombs of Egypt, ii. 121.

Catamountain, hunts for the hair or the rabbit, ii. 154—the ocelot of Mr. Buffon—its description, 434—is one of the fiercest, and, for its size, one of the most destructive animals in the world, 438.

Catanea, a city utterly overthrown by an earthquake, i. 94.

Cataphractus, or kabassou, is one of the largest kinds of the armadilla, iii. 225.

Cataract of the eye; Mr. Cheselden having couched a boy of thirteen, who to that time had been blind, and at once having restored him to sight, curiously marked the progress of his mind upon the occasion, ii. 25.

Cataracts of the Rhine, and of the Nile—the cataract of the river Velino, in Italy, is above an hundred and fifty feet perpendicular—one near Gottenburgh in Sweden—other cataracts, i. 186.

Caterpillars, their differences from all other insects—all these animals are hatched from the eggs of butterflies—during winter the greatest number of caterpillars are in an egg state—in the aurelia state, they are seemingly deprived of life and motion—some do not make any change at the approach of winter, but chuse themselves some retreat, and there remain quite motionless, and as insensible as if actually dead—caterpillars of this kind are found in great numbers together, enclosed in one common web that covers them all—there are some of the kind whose butterflies live all the winter, and where—a single caterpillar eats double its own weight of leaves in a day, and seems no way disordered by the meal—the body of the caterpillar anatomically considered—avidity with which they feed—number of their stigmata, or those holes through which the animal is supposed to breathe—it has eighteen lungs—the experiment of Malphigi to ascertain their use—all caterpillars spin at

one time or another—many of them change their skins five or six times in a season—and in what manner—change into an aurelia—their retreats in that state, vi. 45—there are thousands of fishes, birds, and insects, that live chiefly upon caterpillars—a single sparrow and its mate, that have young ones, destroy above three thousand caterpillars in a week—some of the kind fitted only to live upon leaves and plants, will eat each other in preference to their vegetable food—the bodies of the larger kinds serve as a nest to various flies, that very carefully deposit their eggs in them—number of worms remain within the body of the caterpillar, devouring its entrails, without destroying its life—the ichneumon tribe is not the caterpillar's offspring, as supposed, but its murderers, 73.

Cat-fish, its description, v. 124.

Cats, the wild, hunt for the squirrel or the mouse, ii. 154——the whole tribe seek their food alone, and never unite for mutual defence, nor for mutual support—and, except at certain seasons, are enemies to each other—all of the cat kind devour nothing but flesh, and starve upon any other provision—their greatest force lies in the claws—the cat goes with young fifty-six days, and seldom brings forth above five or six at a time—the male often devours the kittens—before they are a year old they are fit to engender—the female seeks the male with cries; nor is their copulation performed without great pain, and why—cats hunt the serpent in the isle of Cyprus—any animal, weaker than themselves, is to them an indiscriminate object of destruction—the mouse is their favourite game, and they patiently watch a whole day, until the mouse appears—a flagrant mark by which the cat discovers its natural malignity—their eyes see better in darkness than light, and why—if the inhabitant quits the house, the cat still remains—is excessively fond of some plants, such as valerian, marum, and cat-mint—particularly loves fish—its sleep is very light—its hair sends forth shining sparks, if rubbed in the dark—the wild breed with the tame—description of the wild cat—inhabits the most mountainous and woody parts, lives mostly in trees, and feeds only by night—the cat was much higher in esteem among our ancestors than it is at present—laws of Howel concerning the price of cats—cats were not naturally bred in our forests—of all quadrupeds the wild cat is, perhaps, that whose intestines are proportionably the smallest and the shortest; and why—common to the new continent, as well as the old—the blue-cat—the lion-cat, or more properly, the cat of Angora—the cats in Syria and Persia remarkable for their long soft hair, ii. 379—all the cat kind are kept off by the fires which the inhabitants light to preserve their herds and flocks—and they hunt rather by the sight than

the smell—it happens that the lion pursues the jackal or the wild dog, while they are hunting upon the scent, and merely for themselves; the lion is then an unwelcome intruder upon the fruits of their toil—from thence, probably has arisen the story of the lion's provider—the lion devours a great deal at a time, and generally fills himself for two or three days to come—in the deserts and forests, his most usual prey are the gazelles and the monkies, 399—the race of cats noxious in proportion to their power to do mischief—inhabit the most torrid latitudes of India, Africa, and America, and have never been able to multiply beyond the torrid zone—they seldom attack man, though provoked—of all animals these are the most sullen, and, to a proverb, untameable, 431—different classes of the kind, from the lion to the cat, 437—the wild cat and the martin seldom meet without a combat—it is not a match for the martin, iii. 88—the cat of Pharoah injudiciously called the ichneumon, 94—cats of Constantinople, a name of the gennet, and why, 103.

Cattle, we have the best breed of horned cattle in Europe—the large hornless breed in some parts of England, originally from Poland, ii. 226—the Dutch bring great quantities of lean cattle from Denmark, to fatten on their own rich grounds—that of the Ukraine becomes fat and is considered the largest breed of all Europe—in Switzerland these animals grow to a large size—not so in France, 233—size in Barbary, Ethiopia, Persia, and Tartary, 233—leather-mouthed cattle, 254——liable to be destroyed by the South American bat, vampyre, iii. 235.

Caverns, the amazing cavern of Eldenhole in Derbyshire—the dreadful cavern in the country of the Arrian Indians, called the Gulph of Pluto, described by Ælian—cavern of Maestricht—its description—no part of the world has a greater number of artificial caverns than Spain—in general deserted by every race of meaner animals, except the bat—the caverns called Oakley-hole, the Devil's-hole, and Penpark-hole, in England—the cavern of Antiparos, and its discovery, i. 53—how natural caverns formed—two hundred feet as much as the lowest of them is found to sink, 63—one in Africa, near Fez, continually sends forth either smoke or flames, 84.

Caviar, the inhabitants of Norway prepare from eggs found in the body of the porpoise, a savoury liquor, which makes a delicate sauce, and is good when eaten with bread, v. 58—it is made with the roe of the sturgeon—more in request in other countries of Europe than with us—and is a considerable merchandize among the Turks, Greeks, and Venetians—manner of making it, 103.

Causes, the investigation of final causes a barren study; and, like a virgin dedicated to the deity, brings forth nothing, i. 15.

Cayman, a sort of crocodile, v. 294.

Cayopolin, a kind of oppossum—its description, iii. 327.
Cea, an island washed away with several thousand inhabitants, i. 112.
Cenere, a mount of recent appearance, i. 137.
Centinel, some animals carefully avoid their enemies, by placing sentries to warn of danger, and know how to punish such as neglect their post, or are unmindful of the common safety, ii. 158——when the marmouts venture abroad, one is placed as a sentry, upon a lofty rock, iii. 151——the bustards have centinels placed upon proper eminences, where, always on the watch, they warn the flock of the smallest appearance of danger, iv. 150——the flamingo does the same, 325.
Centipes, the scolopendra, v. 437.
Centriscus, a kind of cartilaginous fish, v. 110.
Cephus, name given by the ancients to the monkey now called mona, iii. 313.
Cepola, the description of this fish, v. 123.
Cerastes, or horned viper, described, v. 371.
Cetaceous-fishes, the whale and its varieties resemble quadrupeds in their internal structure, and in some of their appetites and affections—they are constrained every two or three minutes to come up to the surface to take breath, as well as to spout out through their nostril (for they have but one) that water which they sucked in while gaping for their prey—the senses of these animals superior to those of other fishes, and it is most likely that all animals of the kind can hear—they never produce above one young, or two at the most; and this the female suckles in the manner of quadrupeds, her breasts being placed, as in the human kind, above the navel—distinctive marks of this tribe, v. 26.
Chace, men of every age and nation have made that of the stag a favourite pursuit—in our country it was ever esteemed a principal diversion of the great, ii. 308—these sports reserved by sovereigns for particular amusement, and when—in the reigns of William Rufus and Henry the First, it was less criminal to destroy a human being than a beast of chace—sacred edifices thrown down for room for beasts of chace—chace of the stag as performed in England—terms used by hunters in that chace—the same in Sicily,—and in China, 310—chace of the fox—cant terms used by the huntsmen in it, 304——of all varieties, that of the ostrich the most laborious, is also the most entertaining—description of it, iv. 45.
Chaffinch, a bird of the sparrow kind, iv. 247, 249—time of emigration of the hen, 24.
Chamois, a species of antelope, ii. 268—described, 269.
Charles XII. when shot at the siege of Fredericshall, was seen to clap his hand on the hilt of his sword, ii. 68.
Charybdis, a gulph—Nicola Pesce jumped into it, continued

for three quarters of an hour below, and at last appeared holding a golden cup in one hand, and making his way among the waves with the other—description of this gulph, i. 243.

Chasms amazing in the Alps—and still more in the Andes—causes that produce chasms or fissures, i. 53.

Chætodon, or the *cat-fish*, its description, v. 124.

Chatterer, a bird, native of Germany—its description, iv. 187.

Cheese, the inhabitants of Canada use no other than the milk of the hind, or the female of the stag, ii. 320—those of Lapland little and well tasted—never breed mites, 353.

Cheops, the oldest measure of the human figure in his monument, in the first pyramid of Egypt, ii. 111.

Cheselden, after couching a boy of thirteen for a cataract, blind from his infancy, and at once restoring him to sight, curiously marked the progress of his mind upon the occasion, ii. 25.

Chevrotin, or little *Guinea-deer*, the least of all cloven footed quadrupeds, and perhaps the most beautiful—is most delicately shaped—its description—native of India, Guinea, and the warm climates between the tropics—the male in Guinea has horns; but the female is without any—they chiefly abound in Java and Ceylon, ii. 286 &c.

Chicken, an amazing history of it in the egg, by Malphigi and Haller, i. 365——in what manner six or seven thousand are produced at a time at Grand Cairo—capons clutch a fresh brood of chickens throughout the year, iv. 130.

Chigoe, a species of flea infesting the inhabitants of America, v. 412.

Child, history of the child in the womb, i. 375—children of negroes able to walk at two months old; at least to move from one place to another—skin of children newly brought forth, is always red, and why—the size of a new-born infant about tweuty inches, and its weight twelve pounds—in cold countries continue to be suckled for four or five years together—child's growth less every year, till the time of puberty, when it seems to start up of a sudden—in some countries speak sooner than in others, and why—children of the Italians speak sooner than those of the Germans—various methods pointed out to improve the intellects of children, 388—as the child increases in age, the inferior parts proportionably lengthen, 428—inherit the accidental deformities of their parents—instances of it, ii. 91—white children frequently produced from black parents; but never black children from two whites, 93—many instances of the child in the womb being marked by the strong affections of the mother—how performed is not known—hard to conceive that the child, in the womb, should take the print of the father's features, 98.

Chimborazo, a remarkable mountain in South America, i. 126.
Chinese, have neither flats nor sharps in their music, ii. 36—description of that people, 78,
Chorosan, in Persia, bodies previously embalmed and buried in the sands of that country, preserved from corruption for a thousand years, ii. 121.
Chough, description of the Cornish chough, iv. 178.
Chrysalis, or the *durelia*, vi. 57.
Chryses, an island sunk near Lemnos, i. 112.
Circassians described, ii. 85.
Circe, an enchantress, armed her son with a spear headed with the spine of the trigon, v. 85.
Circulation of the blood through the bones, first accidentally discovered by Mr. Belcher—experiment made by him for this purpose—canals for circulation of the blood through the bones, of different capacities in the various stages of life, —circulation through all parts of the body, ii. 57.
Civet, the species distinguished into two kinds; Mr. Buffon calls one the civet, the other the zibet—distinction between the two kinds—the civet thirty inches long—both civet and zibet considered as varieties of the same animal, as former naturalists have done—the civet resembles the weazel kind, in what—differs from them, in what—the opening of the pouch, or bag, the receptacle of the civet—manner of taking the civet from the pouch—although a native of the warmest climates, this animal lives in temperate, and even cold countries—kinds of food it likes best—drinks rarely, yet makes urine often; and, upon such occasions, the male is not distinguished from the female—numbers of these animals bred in Holland, and the perfume of Amsterdam reckoned the purest of any—the quantity greater proportionably to the quality and abundance of the food—this perfume so strong, that it communicates to all parts of the animal's body—to its fur and skin—manner of choosing the perfume—the places of considerable traffic in it—the animal irritated, its scent becomes greater; and tormented, its sweat is still stronger, and serves to adulterate or increase what otherwise obtained from it—civet a more grateful perfume than musk—sold in Holland for fifty shillings an ounce—its eyes shine in the night—sees better in the dark than by day—breeds very fast in climates where heat conduces to propagation—thought a wild fierce animal, never thoroughly familiar—lives by prey, birds, and animals it can overcome—its claws feeble and inflexible—this perfume quite discontinued in prescriptions, iii. 104, &c.
Clavicles, or collar bones, what animals have them—Mr. Buffon says, none but monkies—this is an oversight, i. 424.
Climates, calamities in those where air is condensed by cold, i.

269—— cause obvious, and sufficient to produce blackness of negroes—complexions of different countries darken in proportion to the heat of the region, ii. 87——next to human influence, the climate has the strongest effects upon the nature and form of quadrupeds, 161.

Clove-trees, cut down by the Dutch at Ternate to raise the price of the spice—soon had reason to repent of their avarice, i. 268.

Clouds, the fore-runners of a terrible hurricane, called by sailors the bull's eye, i. 297—dashing against each other, produces electrical fire—water evaporates, and rising forms clouds—theory upon it—that of Dr. Hamilton—the author's theory of evaporation, 312—at once pour down their contents, and produce a deluge—reflecting back images of things on earth, like mirrors, 324.

Clupea, or *herring*, its description, v. 128.

Coaiti, a monkey of the new continent, described, iii. 314.

Coatimondi, extreme length of its snout—its description—very subject to eat its own tail—its habits, iii. 396.

Cobitis, the loach, description of this fish, v. 129.

Cobra di Capello, a kind of serpent, v. 370.

Cochineal, description of this insect as in our shops brought from America—difference between the domestic and wild cochineal—precautions used by those who take care of these insects—the propagator has a new harvest thrice a year—various methods of killing them produce different colours as brought to us—our cochineal is only the females—used both for dyeing and medicine, vi. 155.

Cock, of all birds the cock the oldest companion of man, and first reclaimed from the forest—species of cock from Japan, covered over with hair instead of feathers—the western world had the cock from Persia—Aristophanes's cock the Persian bird—it was one of the forbidden foods among the ancient Britons—Persia, that first introduced it to us, no longer knows it in its natural form—countries where it is wild—peculiarities, in a wild condition—another peculiarity in those of the Indian woods, their bones, when boiled, are black as ebony—the Athenians had cock-matches as we—no animal of greater courage, when opposed to his own species—in China, India, the Philippine Islands, and over the East, cock-fighting the sport and amusement of kings and princes—cocks in China as bold, or bolder, than ours—and of more strength with less weight—its great courage proceeds from being the most salacious of all birds—a single cock suffices for a dozen hens; and is the only animal whose spirits are not abated by indulgence—soon grows old; and in three or four years becomes unfit for purposes of impregnation—how long cocks live, left to themselves, not well ascertained—Aldrovandus makes their age to be ten years—are injured, as Linnæus asserts, by elder-

berries, iv. 123 — the black chiefly found in heathy mountains and piny forests, 152—cock of the wood, 155.

Cockle, a bivalved shell-fish, v. 240.

Cod, from the banks of Newfoundland, pursues the whiting, which flies before it to the southern shores of Spain, v. 13—spawns in one season, as Lewenhoeck afferts, above nine millions of eggs or pease, contained in a fingle roe 21—its description, 127—fishery in Newfoundland, 137.

Cold, exceffive, preserves bodies from corruption, ii. 119—some fishes rendered so torpid, by cold, in northern rivers, as to be frozen up in the maffes of ice, where they continue for months together, without life or sensation; prisoners of congelation, waiting a warmer sun to restore them to life and liberty, v. 153.

Collar-bones, what animals have them, i. 424.

Colour, none refreshes the sight so well as green, i. 12——of the sea, not from any thing floating in it, but from the different reflexions of rays of light, 242—of the blood in the arteries or veins, 275—different colours of the eye, 408—hair takes its colour from juices flowing through it, 412—that of the object contributes to form an idea of the distance at which it appears, ii. 28—of all those by which mankind is diversified, our's most beautiful to the eye, and most advantageous, 86—those changes the African, the Asiatic, or the American undergo, in their colour, are but accidental deformities, which might probably be removed, 94—nothing exceeds the delicate regularity of those of the zebra, 210.

Comets, their number much greater than that of the planets—they roll in orbits—experience has not sufficiently confirmed the truth of the investigation about their returning periods, i. 4.

Complexion, extremity of cold not less productive of a tawny than that of heat—not easy to conceive how the sun whitens wax and linen, and darkens the human complexion—the sun not the only cause of darkening it, ii. 89.

Concretions, scarce an animal, or a part of their bodies, in which concretions are not formed—experience has found but few cures by the efficacy of these concretions—often prove fatal to the animal that bears them, ii. 282.

Condoma, anomalous animal of the goat kind—its description, ii. 285.

Condor, possesses, in a higher degree than the eagle, all the qualities that render it formidable to the feathered kind, to beasts, and to man himself—is eighteen feet across the wings extended, according to Acosta, Jarcilasso, and Desmarchais—the beak so strong as to pierce the body of a cow; two of them able to devour it—they do not abstain from man himself—fortunately there are few of the species—the Indians believe that they will carry off a deer, or a young calf, in their talons,

as eagles would a hare or a rabbit; and that their sight is piercing, and their air terrible; that they seldom frequent the forests, as they require a large space for the display of their wings—they come down to the sea shore at certain seasons, when their prey fails upon land; they then feed upon dead fish, and such nutritious substances as are thrown upon the shore—their countenance not so terrible as old writers have represented—those who have seen this animal, say the body is as large as that of a sheep—many instances of its carrying away children—circumstantial account of this bird by P. Feuillée, the only traveller who has accurately described it—countries where it is found—in the deserts of Pachomac, where it is chiefly, men seldom venture to travel—its flesh as disagreeable as carrion, iv. 77.

Conepate, an animal resembling the fkink in all things except size, iii. 98.

Congar of America, resembles the tiger in natural ferocity, though far inferior in its dimenfions, iii. 393.

Congelation, the heat of blood in man, and other animals, is about thirty degrees above congelation; but in the marmout and other animals, which seem to sleep the winter, the heat of the blood is not above ten degrees above congelation, iii. 152.

Coot, description of that bird—refidence and nest—sometimes swims down the current, till it reaches the sea—dangers encountered in this voyage, iv. 342.

Coquallin, the Brasilian squirrel, so called by Buffon, iii. 138.

Coral, the common red never met with in the fossil world, i. 41.

Coral-serpent, described, v. 370.

Coral-plants, their various appearances—opinion of Count Marsigli upon corals—Mr. Ellis proves it the work of reptiles of the polypus kind—principal experiment to this purpose, vi. 193.

Coralines, called *fungi madrepores*, vi. 197.

Cordyle, the tockay and the tejuguacu fill up the chasm between the crocodile and the African iguana, v. 316.

Corin, name of the third variety of gazelles, by Mr. Buffon, ii. 279.

Cormorant, its description and food—remarkably voracious, with a sudden digestion—its form disagreeable—its voice hoarse and croaking—all its qualities obscene—no wonder Milton makes Satan personate this bird—objection against this passage of Milton's Paradse Lost vindicated—fishes in fresh waters, and in the depths of the ocean—builds in cliffs of rocks, and in trees—preys in the day-time, and by night—once used in England for fishing, and in what manner—how educated in China; for the purposes of fishing—the best fisher of all birds—sometimes has caught the fish by the tail—the fins prevent its being swallowed in that position—how it manages the fish in this case, iv. 364—remarked for the quickness of its sight, 371.

Cornaro lived an hundred years, with a constitution naturally feeble, ii. 63.

Coromandel, amazing size of oysters along that coast, v. 240.

Corrira, or the Runner, a bird of the crane kind—its description, iv. 329.

Corruption, excessive cold preserves bodies from it—and a great degree of dryness produced by heat—earth, if drying and astringent, produces the same effect—bodies never corrupt at Spitsbergen, though buried for thirty years—men and animals buried in the sands of Arabia preserved from corruption for ages, as if actually embalmed—bodies buried in the monastery of the Cordeliers at Thoulouse, preserved from corruption—bodies previously embalmed, buried in the sands of Chosoran, in Persia, preserved from corruption for a thousand years, ii. 119—amazing preservation from it in a mummy lately dug up in France, 125.

Coryphæna, the razor-fish, its description, v. 123.

Cotopaxi, volcano in South America, described by Ulloa, i. 84—more than three geographical miles above the surface of the sea, 126.

Cotton-tree, the seed intoxicates parrots, as wine does man, iv. 221.

Cottus, the bull-head—description of this fish, v. 125.

Couando, much less than the porcupine—its description, iii. 211.

Cougar, the red tiger, by Mr. Buffon—extremely common in South America—in what manner the Indians encounter it, ii. 420.

Coulterneb, remarkable bird of the Penguin kind. See *Puffin*, iv. 389.

Cows allured by music, ii. 39——of ruminant animals, the cow kind deserves the first rank—meanest peasants in Germany, Poland, and Switzerland, kill one cow at least for their own table—salted and hung up, is preserved as a delicacy the year round—cows want the upper fore-teeth—in no part of Europe cows grow so large, yield more milk, or more readily fatten, than in England—make no particular distinction in their herbage, indiscriminately devouring the proper quantity—it gives back more than it takes from the soil—the age of the cow known by the teeth and horns—the number of its teeth—have eight cutting-teeth in the lower jaw—manner of renewing them—the horns more surely determine this animal's age, and how—while this animal lives, the horns lengthen—wants in udder what it has in neck—the larger the dewlap, the smaller the quantity of its milk—the kind to be found in every part of the world—large in proportion to the richness of the pasture—Africa remarkable for the largest and smallest cattle of this kind; as also India, Poland, and Switzerland—among the Eluth Tartars, the cow is so large that a tall man only can reach the tip of its shoulder—of all quadrupeds, the cow

most liable to alteration from its pasture—the breed of the Isle of Man, and most parts of Scotland, much less than in England; also differently shaped—the breed improved by foreign mixture, adapted to supply the imperfections of our own —such as purely British, far inferior in size to those of the continent, 222—the cow, the urus, and the bison, animals of the same kind—difference in size not so remarkable as those in its form, hair, and horns—many considered as a different kind, and names given them as a distinct species, when in reality all the same—only two varieties of the kind really distinct, the cow and the buffalo—they bear an antipathy to each other—scarcely a part of the world where the cow kind is not found—variety of the horns—those in Iceland are without horns—the Barbary cow, or zebu—of all animals, the cow most extensively propagated—an inhabitant of the frozen fields of Iceland, and the burning desarts of Lybia—other animals preserve their nature or their form with inflexible perseverance —the cows suit themselves to the appetites and conveniences of mankind—no animal has a greater variety of kinds, none more humble and pliant—the cow and bison breed among each other—the cow does not breed with the buffalo—no animals more distinct, or have stronger antipathies to each other—the cow goes nine months with young—the grunting, or Siberian cow, and the little African, or zebu, are different races of the bison—animals of the cow kind, by naturalists extended to eight or ten sorts, reduced to two—an animal of the cow kind, by no naturalist described—the description of it, 228—the Greeks compared the eyes of a beautiful woman to those of a cow, 278—it eats two hundred and seventy.six plants, and rejects two hundred and eighteen, 362.

Cow-bezoar, a factitious sort, ii. 282.

Crab, surprising manner in which the monkies draw crabs from the water, iii. 308—found in fresh and salt water, and upon land—description—its intestines have many convolutions—land-crabs of various kinds—some healthful and nourishing—others poisonous or malignant to a great degree—places where found, v. 170.

Crab (violet) of the Caribbee Islands, described—their food—their nippers the principal instrument for seizing and cutting their food—catch such hold that the limb is lost sooner than the grasp—thus it gets off, leaving its claw fastened upon the enemy—the claw performs its duty, and keeps a minute fastened upon the finger, while the crab makes off—it loses no great matter by a leg or an arm; as they grow again, the animal becomes perfect as before—fatiguing and amazing march from the mountains to the sea-shore, to deposit the spawn, from which, soon after, millions of little crabs are seen slowly travelling up the mountains—wait the benefit of sea-water for their delivery—change their shells—have under their stomachs

four white stones, which gradually decrease as the shell hardens, and, when come to perfection, are not to be found—season and manner in which they are caught—in Jamaica they are in great plenty, and considered as one of the greatest delicacies—many of this kind found poisonous, v. 171—soldier-crab seen every year descending from the mountains to the sea-shore to deposit its spawn, and to provide itself with a new shell—contest between them for some well-looking favourite shell, for which they are rivals—strike with their claws—beat each other till the weakest is obliged to yield, and give up the object of dispute—when taken sends forth a feeble cry, endeavouring to seize the enemy with its nippers—not much esteemed for its flesh, 177.

Crane, bred familiarly in our marshes formerly—not now, and why, iv. 25—general characteristics and habits of birds of the crane kind—their food and flesh, 287—description of the crane—Gesner says, its feathers, in his time, were set in gold, and worn as ornaments in caps—description of this bird from antient writers, who have mixed imagination with history—whence have arisen the fables of supporting their aged parents, and fighting with pigmies—the crane a social bird, and seldom seen alone—usual method of flying or sitting, in flocks of fifty or sixty together—while part feed the rest keep guard—subsists mostly upon vegetables—are known in every country of Europe, except our own—are birds of passage—seasons of their migrations, during which they do incredible damage, chiefly in the night—were formerly known, and held in great estimation here, for the delicacy of their flesh—there was a penalty upon destroying their eggs—Plutarch says, cranes were blinded, kept in coops, and fattened for the tables of the great in Rome—at present they are considered all over Europe as wretched eating—qualities of its flesh—their note the loudest of all other birds; and often heard in the clouds, when the bird itself is unseen—amazing heights to which they ascend when they fly—though unseen themselves, they have distinct vision of every object below—extraordinary length and contorsion of its windpipe—use made of their clangorous sound—they rise but heavily, are shy birds, and seldom let the fowler approach them—their depredations usually in the darkest nights, when they enter a field of corn, and trample it down, as if crossed over by a regiment of men—corn their favourite food; scarce any other comes amiss to them—Redi's experiments to this purpose—a little falcon pursues, and often disables it—method used on such occasions by those fond of hawking—barbarous custom of breeding up cranes to be thus baited—easily tamed—Albertus Magnus says, it has a particular affection for man—the female distinguished from the male by not being bald behind—never lays above two eggs at a time—the young are soon fit to fly; and

unfledged, they run with such swiftness that a man cannot easily overtake them—Aldrovandus assures us one was kept tame for above forty years—the vulgar bear the crane a compassionate regard—prejudices in its favour—heinous offence in some countries to kill a crane, 291—distinctions between the crane and the stork, 299.

Crane, the *Balearic*, from the coast of Africa, and the Cape de Verd Islands—its description—habits—has been described by the name of sea-peacock—real Balearic Crane of Pliny—foreign birds of the crane kind described; the jabiru, the jabiru-guacu, the anhima—the buffoon bird, or Numidian crane, described, iv. 303—place where the crane kind seem to have formed their general rendezvous, 321—the flamingo the most remarkable of all the kind, the tallest, bulkiest, and most beautiful—described, 322—small birds of the crane kind, 331.

Cricetus, the *German Rat*, by Mr. Buffon called the hamster—its description—is the greatest pest in the countries where found, and every method made use of to destroy it—its hole a curious object for contemplation; shews a skill superior to the rest of the rat kind—description of it—their storehouses—contain two bushels of good grain in each apartment—means of finding out their retreats—produce young twice or thrice a year, and bring five or six at a time—their devastations produce a famine—they destroy each other—their fur very valuable, iii. 181.

Cricket——difference from the grasshopper—their voice—food—never drink—sound of drums and trumpets make them forsake their situation, vi. 26.

Cricket (mole) described—thought to be amphibious—the number of their eggs—most detested by gardeners—its devastations—precautions of the female against the black beetle—their care and assiduity in the preservation of their young, vi. 29.

Croches, in the head of a stag, ii. 312.

Crocodile, extraordinary combat between this animal and the tiger, ii. 421—the ichneumon discovers and destroys its eggs—kills its young, and sometimes entering the mouth of the crocodile, when sleeping on the shore, effectually destroys it, iii. 95—the eggs it lays in the sand at a time often amount to three or four hundred, 97—the places where found, together with their dimensions—description—several examples of taking a man out of a canoe from his companions, notwithstanding all opposition and assistance—terrible even upon land—its depredations—combats between the crocodile and the tiger—in what manner it seizes its prey—how a negro ventures to attack this animal in its own element—manner of taking it in Siam—often managed like a horse; a curb put into its mouth, and the rider directs it as he likes—manner of taking it along the rivers of Africa—pools of water where bred

as we breed carp in our ponds—in Egypt, and other long-peopled countries, this animal solitary and fearful—in the river San Domingo, they are most inoffensive; children play with them, and ride about on their backs; beat them without receiving the smallest injury—probable opinion, its musky substance amassed in glands under the legs and arms—its flesh—the eggs to the savages most delicate morsels—all breed near fresh waters—precautions in laying their eggs—the female having introduced her young to their natural element, she and the male become their most formidable enemies—the open-bellied crocodile thought viviparous—has a false belly like the oppossum, for the young to creep out and in, as danger or necessity requires—their age—produced to fight at the amphitheatre at Rome, v. 293, &c.

Croppers, a kind of pigeons, iv. 231.

Crossbill, a bird of the sparrow kind, iv. 247, 249.

Crost-fox, an animal between the dog and fox, iii. 62. See *Isatis*.

Crown, in the head of a stag, ii. 312.

Crows fetch and carry with the docility of a spaniel, iv. 171——the *carrion-crow* resembles the raven in appetites, laying, and manner of bringing up its young—the *Royston-crow*, 173.

Crustaceous fishes, v. 161.

Cub, the fox is so called during the first year, iii. 47—born blind, like those of the dog, 49.

Cuckoo, fables invented of this bird, now sufficiently refuted—where it resides in winter, or how provides for its supply during that season, still undiscovered—this bird somewhat less than a pigeon, shaped like a magpie, and of a greyish colour—is distinguished from all other by its round prominent nostrils—discovers itself in our country early in the spring, by its well known call—its note heard earlier or later, as the season is more or less forward, and the weather inviting—from the chearful voice of this bird, the farmer instructed in the real advancement of the year—history and nature of this bird still in great obscurity—its call an invitation to courtship, used only by the male, generally perched upon a dead tree, or bare bough, repeating his song, which he loses when the genial season is over—his note pleasant, though uniform—the female makes no nest—repairs to the nest of some other bird, generally the water-wag-tail or hedge-sparrow, and, after devouring the eggs of the owner, lays hers in their place—usually lays but one—this the little foolish bird hatches with great assiduity, and, when excluded, fondly thinks the great ill-looking changeling her own—to supply this voracious creature, the credulous nurse toils with

unwearied labour, not sensible she is feeding up an enemy to her race—the stomach of this bird is enormous, and reaches from the breast-bone to the vent—its food—naturally weak and fearful—the smaller birds form a train of pursuers; the wry-neck, in particular, the most active in the chace—supposed, in winter, to lie hid in hollow trees, or to pass into warmer climates—story of a cuckoo found in a willow log, in winter—probable opinion concerning its residence in winter—Brisson makes not less than twenty-eight sorts of this bird; and talks of one of Brafil, as making a horrible noise in the forests, iv. 203—Doctor Jenner's admirable account of, 208

Cuckow-spit, or *Froth-worm*, its description, vi. 34.

Cuguacu-apara, name in Brasil for the roe-buck, ii. 333.

Curlew, a small bird of the crane-kind—its dimensions—places where found—manner of procuring its food—its habits—its nest, and number of eggs—a bird of passage, iv. 332.

Currents of rivers well explained by the Italians—to be differently estimated—side current—back current—sometimes the current at bottom swifter than at top, and when—double current, i. 168—found to run in all directions—manner in which mariners judge of the setting and rapidity of the current—currents are generally found most violent under the equator—a passage with the current gone in two days, with difficulty performed in six weeks against it—currents do not extend above twenty leagues from the coast—the currents at Sumatra extremely rapid, run from south to north—also strong currents between Madagascar and the Cape of Good Hope; but the most remarkable are those continually flowing into the Mediterranean-sea—current runs one way at top, and the ebb another way at bottom, 217.

Current of air, driven through a contracted space, grows more violent and irresistibile, i. 293.

Cusco, (*Garcilasso*,) de la Vega, asserts the air is so dry and so cold there, that flesh dries like wood, without corrupting, ii. 119.

Cuttle-fish, its description—contrivance with which it is furnished by nature, when under a difficulty of escaping, vi. 182.

Cybotus, a lofty mountain swallowed by an earthquake, i. 136.

Cynocephalus, the *Magot* of Buffon, the last of the ape kind —its description—is a native of Africa and the East, i. 292.

Cyprinus, or the carp, v. 129.

D.

Dam, in the rapacious kinds, leads her young forth for months together; it is not so with those of the hare kind, iii. 120.

Dampier, the celebrated navigator, has added more to natural history than half the philosophers before him—the first who informed us of the distinctions between such turtles as are malignant and such as are wholesome—saw one at Jamaica that measured six feet broad, v. 193.—his curious observations on the winds in warm climates, i. 289——observes the flamingos, when seen in the day, always appear drawn up in a long close line of two or three hundred together, and present, at the distance of half a mile, the exact representation of a long brick wall—they always appoint one of the number as a watch, iv. 325—says their flesh is well tasted, 327.

Damps, of various natures in mines—the fulminating sort i. 74, 75.

Dancer, a dog of the mongrel kind, iii. 13.

Dane, the tallest dog bred in England, iii. 17.

Danish-dog, descended from the mastiff, iii. 12.

Dara, its inhabitants use ostriches as horses, iv. 47.

Darien, an isthmus—has a particular hog, called warree—described by Wafer, ii. 378.

Darkness, surprising how far the eye accommodates itself to it—remarkable instance of it in a gentleman, a major under Charles the First, ii. 31.

Deaf men often found to see the force of those reasonings, which they could not hear, understanding every word as it was spoken, i. 414—one born deaf must necessarily be dumb—instances of two young men, who, born deaf, were restored to hearing—a person born deaf, by time and pains, taught to write, read, speak, and, by the motion of the lips, to understand what is said—instances of it, ii. 43.

Deafness, one of the most common disorders in old age—way to know this defect, either internal or external, ii. 41.

Death, a young man born deaf and dumb, knew nothing of death, and never thought of it till the age of twenty-four, when he began to speak of a sudden, ii. 43—a spectre which frights us at a distance, but disappears when we come to approach it—uncertainty of the signs of death, 67.

Deer, annually shedding horns, and their permanence in the sheep, draws a distinct line between their kinds, ii. 248—the little Guinea-deer, the least of all cloven-footed quadrupeds, and most beautiful—its description, 286—all of the deer kind want the gall bladder, 296—a downy substance

like velvet upon the skin covering the skull of a deer, when the old horn is fallen off, 298—their horns grow differently from those of sheep or cows—they are furrowed along the sides, and why, 299—the bran deer or the brown deer, called by the ancients tragelaphus, found in the forests of Germany, 318—the new continent of America produces animals of the deer kind, in sufficient plenty, 319.

Deer (fallow) no animals more nearly allied than the stag and fallow deer, yet they never herd nor engender together, nor form a mixed breed—each form distinct families, and retain an unalterable aversion—the fallow deer rarely wild in the forests; are in general bred in parks, and their flesh is preferred to that of any other animal—a herd of them divides into two parties, and engage each other with great ardour and obstinacy—both desirous of gaining a favourite spot of the park for pasture, and of driving the vanquished into the more disagreeable parts—manner of their combats—are easily tamed—and browze closer than the stag—they seek the female at their second year—their strength, cunning, and courage inferior to those of the stag—we have in England two varieties of the fallow-deer; one brought from Bengal, the other from Norway—flesh of the French fallow deer, has not the fatness nor the flavour of that fed upon English pasture—Spanish and Virginian fallow deer—deer without horns, their description, ii. 320, &c.

Deer (rein) the most extraordinary, and most useful—native of the icy regions of the North—it answers the purposes of a horse—attempts made to accustom it to a more southern climate, in a few months it declines and dies—answers the purposes of a cow in giving milk; and of the sheep in furnishing warm cloathing to the people of Lapland and Greenland—description of the rein deer—its rutting time, and that of shedding its horns—difference between this deer and the stag—it is not known to the natives of Siberia—Americans call it caribou—herdsmen of Lapland known to possess a thousand rein deer in a single herd—it subsists upon moss—and makes the riches of the people of Lapland—gnats and gadflies very formidable to this deer in Lapland—female brings forth in May—its milk thinner than that of the cow; sweeter and more nourishing, ii. 340—is of two kinds in Lapland—it draws sledges—can go about thirty miles without halting, and without dangerous effort—generally castrated by the Laplanders—one male left to six females—begin to breed when two years old—go with young eight months, and bring two at a time—fondness of the dam remarkable—live but fifteen or sixteen years—manner in which the Laplanders kill them—scarce any part of this animal not converted to peculiar uses—the Laplanders find their necessities supplied from the rein deer alone—in what

manner—diseases of this animal—the blood of the rein deer preserved in small casks for sauce with the marrow in spring—the horns converted into glue—the sinews make the strongest sewing thread—the tongue a great delicacy—the intestines, washed like our tripe, in high esteem among the Laplanders—bears make depredations upon the rein deer—glutton its most dangerous and successful persecutor—only method of escape from this creature, 350—in what manner the rein deer is killed by it, 357—the wolf never attacks a rein deer that is haltered in Lapland, and why, iii. 41.

Deformity, children often inherit even the accidental deformities of their parents—instances of it—accidental deformities become natural by assiduity continued and encreased, through successive generations, ii. 91.—all those changes the African, the Asiatic, or the American undergo, in their colour, are accidental deformities, probably to be removed, 94.

Demoſeille, name given by the French to the Numidian bird, iv. 307.

Depona, a large serpent, native of Mexico, v. 380.

Desman, one of the three distinctions of the musk rat—a native of Lapland, iii. 179.

Devil (sea) or fishing-frog described, v. 106.

Dew, compensates the want of showers in Egypt, i. 295.

Dewlap, of two zebras, seen by the author, the skin hung loose below the jaw upon the neck, in a kind of dewlap, ii. 216—the cow wants in udder what it has in neck, and the larger the dewlap the smaller the quantity of its milk, 227.

Diableret, a mountain in France suddenly fallen down—its ruins covered an extent of a league square, i. 131.

Dictionaries of Arts and Sciences, a fault that has infected most of them, ii. 145.

Diet, of a thin sparing kind, remarkable among quadrupeds, as well as the human species, to produce hair, iii. 77.

Digester, an instrument—meat and bones put into it, dissolved into a jelly in six or eight minutes, i. 255.

Digestion, these organs in birds are in a manner reversed, iv. 11——not perfect in birds that live upon mice, lizards, or such like food, 110—performed by some unknown principle in the stomach, acting in a manner different from all kinds of artificial maceration—this animal power lodged in the maw of fishes, v. 11.

Disorders, infectious, propagated by the effluvia from diseased bodies, i. 270——most of those incident to mankind, says Bacon, arise from the changes of the atmosphere, v. 19—fishes have their disorders, 154.

Diver, (the great northern) a bird of the smaller tribe of the

penguin kind—the grey speckled diver, the scarlet-throated diver, iv. 389.

Divers known to descend from twenty to thirty fathom—of all those who have brought information from the bottom of the deep, Nicolo Pesce the most celebrated—account of his performances by Kircher, i. 242—some known to continue three quarters of an hour under water without breathing—they usually die consumptive—manner of fishing for pearls, v. 245.

Dodo, its description—among birds, as the sloth among quadrupeds, an unresisting animal, equally incapable of flight or defence—native of the isle of France—the Dutch first discovered and called it the nauseous bird—travellers deem its flesh good and wholesome—it is easily taken—three or four dodos enough to dine a hundred men—whether the dodo be the same bird with that described under the name of the bird of Nazareth remains uncertain, iv. 57.

Doe, the female of the deer kind, ii. 323.

Dogs, always running with their noses to the ground, supposed of old the first that felt infection, i. 263——no other animal of the carnivorous kind will make a voluntary attack, but with the odds on their side, ii. 153——the Arabian horses out-run them, 176—in the dog kind the chief power lies in the under jaw, ii. 381—in Syria, remarkable for the fine glossy length and softness of their hair, 391—in tropical climates lose the delicacy of their scent, and why—the lion, tiger, panther, and ounce, all natural enemies to the dog, 433—dog kind not so solitary as those of the cat, iii. 2—their proper prey are animals unfitted for climbing—they can live for some time upon fruits and vegetables, 3—description of the dog—knows a beggar by his cloaths, by his voice, or his gestures, and forbids his approach, 4—the dog most susceptible of change in its form, 7—all dogs are of one kind—which the original of all—which the savage dog—whence such a variety of descendants is no easy matter to determine—the shepherd's the primitive animal of his kind—those wild in America and Congo, as those of Siberia, Lapland, Iceland, of the Cape of Good Hope, of Madagascar, Calicut, and Malabar, resemble the shepherd's dog—those in Guinea, at the second or third generation, forget to bark—dogs of Albany, of Greece, of Denmark, and of Ireland, larger and stronger than any other—shepherd's dog, transported into temperate climates, and among people entirely civilized, from influence of climate and food alone, become a matin, a mastiff, or a hound—*Turkish dog—great Danish dog—great Irish Wolf dog—the little Danish dog*—their variety now in England much greater than in the time of queen Elizabeth—Dr. Caius divides the whole race into three kinds—the generous; the farm kind; the mongrel, 9.

&c.—three shepherd's dogs reckoned a match for a bear, and four for a lion—three of them overcame a lion in the time of King James the First—the famous poet, Lord Surry, the first who taught dogs to set—the *pug dog*—the English *bull dog*—the *lion dog*—originally from Malta—its description —the *Molossian dogs* of the ancients, according to Mr. Buffon—*Epirotic dogs*, mentioned by Pliny—*Indian dogs*, mentioned by Ælian—his description of a combat between a dog and a lion—the bravest of the kind—the nobler kind of dogs, of which such beautiful ancient descrip ions, now utterly unknown, 13—puppies eyes not open till ten or twelve days old—dog's teeth amount to forty-two—this animal capable of reproducing at the age of twelve months—goes nine weeks with young, and lives about twelve years—other particulars concerning dogs—many kinds of birds the dogs will not touch—dogs and vultures living wild about Grand Cairo in Egypt, continue together in an amicable manner, and are known to bring up their young in the same nest—dogs bear hunger for a long time—a bitch, forgotten in a country-house, lived forty days without any other sustenance than the wool of a quilt she had torn in pieces, 26—the wild, hunt in packs—unknown, such as he was before the protection of man—some, from a domestic state, have turned savage, and partaken of the disposition of the wolf, and attack the most formidable animals of the forest—are easily tamed, and quickly become familiar and submissive, 6—experiments to prove the wolf and the fox not of the same nature with the dog, but of a species perfectly distinct—animals in this country bred between a dog and a fox, 24—a dog set at liberty, in his savage fury flew upon every animal, fowls, dogs, and men, 25—the dog and wolf so much alike internally that anatomists can scarce perceive the difference—a young dog shudders at the sight of a wolf—dogs and wolves so different in their dispositions, that no animals have a more perfect antipathy, 32—by instinct, without education, dogs take care of flocks and herds—shew no appetite to enjoy their victory when the wolf is killed, but leave him where he falls, 33—Catesby asserts the wolf was the only dog used by the Americans before the Europeans came among them, and that they have since procreated together; thus proving the dog and the wolf of the same species, 42—unsurmountable antipathy between the dog and the jackall—they never part without an engagement, 59—famished dogs more hairy than those whose food has been more plentiful, 78—all kinds pursue the hare by instinct, and follow it more eagerly than other animals, 119—few dogs dare to encounter the otter, 241—some purposely trained for discovering the retreat of the otter, 242.

Dog-butchers all over China, and shambles for selling their flesh

—wherever a dog-butcher appears, all the dogs of the place are in full cry after him—along the coasts of Guinea, their flesh is esteemed a delicacy by the negroes; they give a cow for a dog, iii. 23.

Dolphin caught in the Red Sea known by a ring to be the same taken before in the Mediterranean, i. 219——allured by music, ii. 38——not easy to assign a cause why the ancients have invented so many fables on the subject—their boundings in the water have taught mariners to prepare for a storm—old painters and sculptors have drawn them wrong; the poets have adopted the error—Pliny has asserted they instantly die when taken out of the water; Rondelet assures us he has seen a dolphin carried alive from Montpellier to Lyons—their motions the gambols of pleasure, or the agitations of terror, not well known—in fairer weather they herd together, and pursue shoals of various fish with impetuosity, v. 34.

Dolphin is also the name of the ophidium, or the gilt-head, v. 122.

Dorado, a fish of the spinous kind, the most voracious—its description—the flying-fish is chiefly sought by it—warfare carried on between them, v. 149.

Doree, description of this fish, v. 125.

Dormouse, the mercury of the thermometer plunged into the body of the living dormouse, never rose beyond its pitch in air, and sometimes sunk above a degree, iii. 153—the greater sort Mr. Buffon calls the *loir*: the middle size he calls the *leret*; and the less he denominates the *muscardin*—their descriptions—agree in being stupified like the marmout during winter—their nests and provisions—they bring forth three or four young at a time, but once a year, in the spring, 177.

Dorr-beetle, or *May-bug*, vi. 141. See *Beetle.*

Dottrel, a small bird of the crane kind, iv. 332.

Doves, the *ring-dove*, iv. 231—the *turtle-dove*, 228—the *stock-dove*, 224. See *Pigeon.*

Doue, a monkey of the antient continent, so called in Cochinchina, where it is a native—its description—forms part of the chain by which the monkies of one continent are linked with those of the other, iii. 314.

Draco-volans, a flying ball of fire, i. 325.

Drag, name given by the huntsmen to the tail of the fox, iii. 47.

Dragons, the whole race dwindled down to the flying lizard, v. 322.

Dragon-fly, or the libella, described, vi. 2.

Dragonet, a description of this fish, v. 123.

Drill of Purchas, an ape of the ouran-outang kind, iii. 277.

Dromedary, a sort of camel, iii. 371.

Drones, the second sort of bees, supposed to be the males—

their cells—the working bees kill the drones in the worm state, in the cell, and eject them from the hive, among the general carnage, vi. 93, &c.

Dryness, a great degree of it produced by heat, preserves from corruption, ii. 119.

Duck, when ducks are caught, the men keep a piece of turf burning near their mouths, and breathe upon it, lest the fowl smelling them, should escape, iv. 9.—Plutarch assures us, Cato kept his family in health, feeding them with duck, whenever they threatened to be out of order, 398—its eggs often laid under a hen—seems a heedless, inattentive mother—of the tame duck, ten different sorts; and of the wild, Brisson reckons above twenty—the most obvious distinction between the wild and tame ducks—difference between wild ducks among each other—sea, and pond ducks—names of the most common birds of the duck kind—among ourselves, and of the most noted of the foreign tribe—their habits, nests, and number of eggs—are, in general, birds of passage—their flesh—the ducks flying in the air, often lured down from their heights by the loud voice of the mallard from below—what part of the lake they generally choose—what can employ them all day not easy to guess—manner of making and managing a decoy to take them—the American wood-duck—general season for catching them in decoys, from the end of October till February—taking them earlier prohibited by an Act of George the Second, imposing a penalty of five shillings for every bird destroyed at any other season—amazing quantity of ducks sent to supply the markets of London—manner of taking them frequently practised in China, 409, &c.

Dunlin, a small bird of the crane kind, iv. 332.

Dwarf, in England, as late as the times of king James the First the court was furnished with one; and he was called Little Jeffery—Peter of Russia celebrated a marriage of dwarfs, ii. 100—they seem to have faculties resembling those of children—history of a dwarf accurately related by Mr. Daubenton, 103.

E.

Eagle-kind, the flap of an eagle's wing known to lay a man dead in an instant, iv. 7—it flies at the bustard or the pheasant, 61—distinctive marks from the other kinds of carnivorous birds, 64, 72—the golden eagle is the largest and noblest of all those birds designed by the name of eagle—its description—considered among birds as the lion among quadrupeds—strong similitude to each other—great patience, and much art, required to tame an eagle—though taken young, and brought under by long assiduity, yet it is a dangerous domestic, and often turns its force against its master—sometimes

has an attachment for its feeder; it is then serviceable, and will provide for his pleasures and support—flies the highest of all birds, and from thence has by the ancients been called the bird of heaven—it has also the quickest eye; but its sense of smelling is far inferior to that of the vulture—it never pursues but in sight—finds difficulty in rising when down—carries away geese, cranes, hares, lambs, and kids, and often destroys fawns and calves, to drink their blood, and carries a part of their flesh to its retreat—infants, when left unattended, have been destroyed by these rapacious creatures—the eagle is peculiarly formidable when bringing up its young—a poor man got a comfortable subsistence for his family, during a summer of famine, out of an eagle's nest, by robbing the eaglets of food—eagles killed a peasant who had robbed their nests—there is a law in the Orkney islands, which entitles any person that kills an eagle to a hen out of every house in the parish in which the plunderer is killed—the nest of the eagle is usually built in the most inaccessible cliff of the rock—description of one found in the Peak of Derbyshire—it hatches its eggs for thirty days—very rare to find three eaglets in the same nest; and it is asserted, that the mother kills the most feeble, or the most voracious—it is believed they live above an hundred years, and that they die, not of old age, but from the beaks turning inward upon the under jaw, and preventing their taking any food—an eagle endured hunger for twenty-one days, without any sustenance whatever—they are first white, then inclining to yellow, and at last light-brown—age, hunger, captivity, and diseases, make them whiter—those kept tame are fed with every kind of flesh, fresh or corrupting; and upon a deficiency of that, bread, or any other provision, will suffice—it is dangerous approaching them, if not quite tame; and they sometimes send forth a loud, piercing, lamentable cry, which renders them still more formidable—they drink but seldon, and perhaps, when at liberty, not at all—the bald eagle an inhabitant of North Carolina—breeds in that country all the year round—manner in which the eggs are hatched—characteristics and habitudes of this animal—its nest is large enough to fill the body of a cart, and commonly full of bones half eaten, and putrid flesh, the stench of which is intolerable, iv. 65, &c.

Eagle, the *sea eagle* called *aquila piombina* by the Italians—they often lay three or four eggs, of a less size than those of a hen, of a white elliptical form—distinctive marks of the *golden-eagle*, of the *common eagle*, of the *bald eagle*, of the *white eagle*, of the *kough-footed eagle*, of the *white-tailed eagle*, of the *erne*, of the *black eagle*, of the *sea eagle*, of the *osprey*, of the *jean le blanc*, of the *Brasil eagle*, of the *Oroonoko eagle*, of the *crowned African eagle*, of the *eagle* of *Pondicherry*, iv. 71.

Ears, distinguishing features in quadrupeds—serve in them as

principal marks of the passions—smallest ears in men said to be most beautiful—the largest the best for hearing—some savage nations bore their ears, and draw that part down, till the tip of the ear rests upon the shoulder, i. 418—undulations, which strike the ear, supposed but one continued sound, by their quick successions, though in reality they make many, ii. 34—persons hear differently with one ear from the other—these have what musicians call a bad ear; and, as hearing false, also sing false—such persons also deceived as to the side whence the sound comes, 42—from what cause the small ears of the Tartars and Chinese, 92—those of the hare moveable, and capable of direction to every quarter, iii. 118—are remarkably good, 122—birds have not the external ear standing out from the head—probably the feathers encompassing ear-holes, supply the defect of the exterior ear, iv. 8.

Earth, its globe a million of times less than the sun, i. 2—placed at a happy middle distance from the centre, in our solar system—less distant from the sun than Saturn, Jupiter, and Mars, and less parched up than Venus and Mercury, situated too near the violence of its power—the earth, like a chariot-wheel, has a compound motion—its rotundity proved—is rather flatted at the poles, and its form resembles that of a turnip, 6—considered as one scene of extensive desolation, 16—supposed by Buffon a globe of glass—by Whiston, a sphere of heated iron—by Kircher, one dreadful volcano—by Burnet a great mass of water—composed of different layers or beds, lying horizontally, one over the other, like the leaves of a book, 46—by Hutton supposed to have existed from eternity, and that there is no trace of beginning or end, i. 30—by Whitehurst, to have originated from a fluid state, and gradually become solid, 34.

Earth (garden) or mould-earth, a kind of mother, never found an enemy to man, i. 46——black earth formed by decayed leaves and branches in Burgundy, 49—drying and astringent earth preserves bodies from corruption, ii. 119——all such earths as ferment with vinegar, are a composition of shells, decayed, and crumbled down to one uniform mass, v. 210.

Earthquakes, frequent through the whole region where a volcano is situated, i. 76—various kinds of them distinguished by philosophers, and by Mr. Buffon—air the only active operator in them—several opinions upon the cause of them—activity of internal heat alone sufficient to account for every appearance attending earthquakes—twelve cities in Asia Minor swallowed up in one night—extraordinary earthquake related by Pliny—account of that in the year 1693, extending to a circumference of two thousand six hundred leagues—minute description of that in Jamaica in 1692—account of the dreadful shock in Calabria in 1638—concomitant circumstances attending earthquakes, 88.

Earth-worm, of America, often a yard in length, and thick as a walking cane, i. 350—its description, vi. 172.

Earwig, its habits—reproaches groundless about this animal—its food—general characteristics of the kind—lives in its winged state a few days—dies to all appearance consumptive, vi. 31.

Echeneis, the sucking-fish—its description, v. 127.

Echini, or urchins, a multivalve shell-fish, v. 248. See *Urchins*.

Echo, no art can make an echo, ii. 41.

Eel described, v. 126.

Effluvia from diseased bodies propagate disorders called infectious, i. 270.

Egg, all birds, most fishes, and many of the insect tribes, brought forth from eggs, i. 365—warmth of the sun, or of a stove, efficacious in bringing the animal in the egg to perfection—its description—history of the chicken in the egg, to its complete formation, 366—the ichneumon discovers and destroys the eggs of the crocodile—the crocodile lays in the sand at a time three or four hundred, iii. 95.—such birds as undisturbed lay but two or three eggs, when their eggs are stolen lay ten or twelve—a common hen, moderately fed, lays above an hundred, from the beginning of spring to the latter end of autumn, iv. 23—some of the ostrich weigh above fifteen pounds, 43—inhabitants of Norway prepare from the eggs of the porpoise a kind of caviar, or delicate sauce, and good when eaten with bread, v. 58—manner in which the eggs of fishes are impregnated wholly unknown, 147—doubts whether fish come from the egg completely formed, 145—those of the turtle hatched by the sun, 197.

Eggs (sea) name given in our cabinets to a multivalve shell-fish, called echini, or urchins, by naturalists——those of the sea-urchin a great delicacy, v. 248.

Egypt, has south winds, so hot during summer that respiration is almost stopped by them—they are charged with such quantities of sand, that they darken the air, as with a cloud—it rains very seldom in that country, but the want of showers is compensated by the copiousness of their dews, i. 295——a mummy, not long since dug up in France, shews the art of embalming more completely understood in the western world, than in Egypt itself, ii. 125—the ichneumon used in this kingdom for the same purposes, that cats are in Europe, iii. 94.

Egyptians carried the art of embalming to the highest perfection—copious detail of it, ii. 113—paid divine honours to the ibis—Maillet's observations concerning this bird, iv. 302.

Eider-duck, iv. 411—remarkable for the warmth of its nest, 413—furnishes the valuable luxury called Eider-down, 420.

Elasticity of the air, i. 248, 251.

Elephant, not afraid singly to make opposition to the lion, ii. 402—not less remarkable for its size than its docility—all historians concur in giving it the character of the most sagacious animal next to man—its height from seven to fifteen feet—impossible to give an idea of this animal's figure by description; assisted by the art of the engraver, it will but confusedly represent the original—general observations about its conformation—of all quadrupeds the elephant the strongest, and largest; yet neither fierce, nor formidable—in its native deserts seldom alone, being a social, friendly creature—the oldest conducts the band; the next in seniority brings up the rear—order maintained in dangerous marches—never so far asunder as to be incapable of reciprocal assistance—their invasions the more disagreeable, there being no means of repelling them, since an attempt to molest a drove would certainly be fatal—manner of going against him who offers the insult—do no personal injury when suffered to feed uninterrupted—molested by man, they seek all occasions to be revenged—where they like best to live in their natural state—cannot live far from water; and always disturb it before they drink—often fill their trunk with water, to cool it, or by way of play to spurt it out like a fountain—equally distressed by the extremes of heat and cold—swim from the continent into islands some leagues distant—frequently migrate from one country to another, and why—their food of the vegetable kind, loathing all sort of animal diet—one finding a spot of good pasture, invites the rest to partake of it—precautions by Negroes and Indians against them—they often break through their fence, destroy the harvest, overturn their habitations, and then retreat in order, as they made the irruption—looks with attention and friendship at its master—its ears wipe its eyes, and cover them against the dust and flies—it likes music, learns to beat time, move in measure, and join its voice to the sound of the drum and trumpet—is pleased with the odours that delight man—the orange flower particularly grateful to its taste and smell—picks up flowers and is pleased with the scent—seeks the most odoriferous plants for food—prefers the cocoa, the banana, the palm, and the sago tree to all others—eats plants to the roots—their sense of touching most delicate—description of its trunk—serving all the purposes of a hand—breathes, drinks, and smells through the trunk—take a pin from the ground, unties knots of a rope, unlocks a door, and writes with a pen, iii. 332——an object too large for the trunk to grasp, is sucked up by its breath, lifted and sustained—the trunk its organ of smelling, of touching, of suction, of ornament, and defence—its neck so short that it must turn about to discover what is behind it—how the hunters escape its resentment—a description of its legs—

while young it bends the legs; but when old, or sickly, it wants human assistance, and chuses to sleep standing—a description of its feet, and of its tusks—these, with age, become so heavy that it is obliged to rest them in holes in the walls of its stall—they are two—their amazing size—they proceed from the upper jaw, not from the frontal bones—and are not horns as some have supposed—nor ever shed in a domestic state—Ælian saw an elephant write Latin characters on a board, his keeper only shewing him the figure of each letter—extraordinary manner of eating—is not a ruminating animal—its stomach and intestines resemble those of a horse—opinion that the young elephant sucks with its trunk, not with its mouth, referred to future discoverers—the skin not covered with hair, a few bristles in the scars and wrinkles of the body, and thinly scattered over the skin; the hide resembles the bark of an old tree, more than the skin of an animal—is subject to that disorder known by the name of elephantiasis, or Arabian leprosy—in what manner the Indians endeavour to prevent it—the flies torment this animal incessantly—what arts it tries to keep them off—in a state of nature, it rarely quits the river, and often stands in water up to the belly—from time immemorial employed for the purposes of labour, of war, to increase the grandeur of eastern princes, or to extend their dominions, 339—is a native of Africa and Asia—still retains its natural liberty in Africa—during the splendour of the Carthaginian empire, they were used in the wars—no elephants found on this side Mount Atlas—places where they are in great numbers—the greatest elephants found in Asia—their price increases in proportion to their size—the largest kept for princes—their colour—that appropriated for the monarch's own riding, kept in a palace, attended by nobles, and almost adored by the people—opinions concerning the white elephant—the eastern princes maintain as many elephants as they are able, and place great confidence on their assistance in an engagement—they never breed in a state of servitude, and the generative powers fail when it comes under the dominion of man—duration of pregnancy in the female still a secret—what Aristotle and others say concerning this and their young is doubtful—method of taking them wild in the woods—Negroes of Africa, who hunt this animal for its flesh, take it in pit-falls—its attachment to the person that attends it—it comprehends several of the signs made to it, distinguishes the tone of command from that of anger or approbation, and acts accordingly—executing orders with prudence, eagerly, yet without precipitation—is taught to kneel down to receive its rider, usually mounted upon its neck—caresses those it knows, salutes such as it is ordered to distinguish, and helps to take up its load—takes a pleasure in the finery of its trappings—draws chariots, cannon, or shipping,

with strength and perseverance; and satisfaction, provided it be not corrected without a cause, and that its master be pleased with its exertions—in what manner the conductor guides it—frequently takes such an affection to its keeper, as to obey no other—has been known to die of grief for killing its conductor in a fit of madness—surprising instance of moderation in its fury—a word sufficient to put it into motion, 334—a century or two ago, the Indian generals made great dependence upon the number and the expertness of their elephants—of late they are little used, except for drawing cannon, and transporting provisions—still they are used in war in Siam, in Cochin-China, in Tonquin, and Pegu—in what manner armed and led to battle—effects of its fury in the field—those placed upon its back in a square tower, combat as from an eminence, and fling down their weapons with double force—nothing more dreadful, or more irresistible, than such moving machines, to men unacquainted with the modern arts of war—Romans quickly learned the art of opening their ranks to admit the elephant, and separating it from assistance, compelled its conductors to calm the animal's fury, and to submit—sometimes, instead of obeying, turned upon those it was employed to assist—one elephant is known to consume as much as forty men in a day—they are now chiefly employed in carrying or drawing burthens throughout the peninsula of India—it can, with ease, draw more than six horses can remove—it carries upon its back three or four thousand weight; and upon its tusks it can support near a thousand—when pushed, it moves as swiftly as a horse at full gallop—it travels fifty or sixty miles a day; and, hard pressed, almost double that quantity—heard trotting on at a great distance—its track is deeply impressed on the ground, and from fifteen to eighteen inches in diameter—used in India as executioners, and with what dexterity they perform the horrid task—sometimes they impale the criminal on their enormous tusks—two surprising instances how sensible it is of neglect—the keeper despising its endeavours in launching a ship, the animal redoubled its efforts, fractured its skull, and died upon the spot—revenge one of them took upon a taylor who pricked its trunk with a needle at Delhi—is mindful of benefits—instance of it—at the Cape of Good Hope they are hunted for the sake of their teeth—in what manner—account of an unhappy huntsman—teeth of the elephant found in a fossil state—two great grinding teeth, and part of the tusk of an elephant, discovered at the depth of forty two yards, in a lead mine in Flintshire, 351—tusks of the elephant that come from Africa seldom exceed two hundred and fifty pounds, 356.

Elephantiasis, or the Arabian leprosy, a disease to which man and

the elephant are equally subject—in what manner the Indians endeavour to prevent it, iii. 343.

Ellis, his principal experiment upon coraline substances, vi. 193.

Elk, it size equal to that of the elephant—is an animal rather of the buck than the stag kind—known in America by the name of moose deer—is sometimes taken in the German and Russian forests; but extremely common in North America—its horns fortuitously dug up in many parts of Ireland, measuring ten feet nine inches from tip to tip—a small one the size of a horse, and the horns little larger than those of a common stag—Jocelin and Dudley describe this animal about eleven feet high; others extend their accounts to twelve and fourteen feet—never disturbs any other animal, when supplied itself—a female of this kind shewn at Paris in the year 1742—its description—they gave it thirty pounds of bread every day, besides hay; and it drank eight buckets of water, ii, 333.

Elk, (American) of two kinds, the grey and the black; described—they prefer cold countries, feeding upon grass in summer, and the bark of trees in winter—time and manner of hunting them—its flesh very well tasted, and very nourishing—its hide strong, and so thick as to turn a musket-ball; yet is soft and pliable—this animal troubled with the epilepsy—is but very indifferently and confusedly described by travellers—their various descriptions, ii. 336—in what manner killed by the glutton, iii. 111.

Elops, or *Sea-serpent*, its description, v. 126.

Ely, an island, the country round it was once a most delightful spot—producing grapes that afforded excellent wine—the sea breaking in, overwhelmed the whole country, i. 232.

Embalming, the Egyptians carried this art to perfection—copious detail of this art as practised among them—in Genesis, Joseph seeing his father expire, ordered his physicians to embalm the body—various methods of embalming—the art still among the Guanches, ancient inhabitants of the island of Teneriffe, when the Spaniards conquered it—particulars of their method of embalming—the Peruvians also understood this art, according to Father Acosta, ii. 121—a mummy lately dug up in France, shews the art more completely understood in the western than the eastern world, 125.

Embryo, its first rudiments—in a month an inch long—the male developes sooner than the female—progress and increase of it, i. 375—in the human the under jaw much advanced before the upper, 414—brain and spinal marrow first seen begun, ii. 20—the bones as soft as the flesh, 57.

Emigration, causes of emigrations of birds, iv. 24—in what manner performed, 26.

Emu, an inhabitant of the new continent, called also the American ostrich—description and places where found—runs so swiftly the dogs lose the pursuit—one surrounded by hunters, the dogs avoided its rage—peculiar in hatching its young—the young at first familiarly follow any person—as they grow older become cunning and distrustful—their flesh good to be eaten—they live entirely upon grass, iv. 48.

Encoubert of Buffon, the tatou of Ray, a shelly quadruped, iii. 224.

England claims dominion over the seas encompassing Great Britain and Ireland—losing its superiority upon the ocean, its safety becomes precarious, i. 295.

Entry, a term in the chace of the stag, ii. 312.

Ephemera, various kinds of this insect—its description—colours of their aurelias—their transmutations—places where found in abundance—short duration—their impregnation, vi. 36.

Equator, description of the regions under it, i. 10,

Ermine, its description—alike in figure to the weasel, its fur the most valuable of any—the time in which it is called the stoat—manner of moulting its hair—one ate honey, and died shortly after—proof of a distinct species from the pole-cat or the martin—one of these, fed with eggs and flesh, let them putrefy before it touched either—in Siberia, taken in traps baited with flesh; and in Norway, shot with blunt arrows, or taken in traps—sometimes found white in Great Britain, and is then called white weasel—its fur among us of no value, iii. 76, &c.—preys upon the leming, 188.

Erne, kind of eagle—its distinctive marks, iv. 73.

Esculapian serpent of Italy, a domestic creature, v. 377.

Esox, or the pike, description of this fish, v. 128.

Esquimaux Indians described, ii. 72.

Evaporation, cold diminishing the force of menstruums, promotes evaporation—theory for the formation of the clouds—prevented by moist weather—dry frost assists evaporation, i. 313.

Europeans resemble our common parent more than any of the rest of his children—argument which suffices to prove it, ii. 93.

Eustachian tube, a passage from the ear into the mouth—its use, ii. 141.

Exhalations, mineral, raised by subterranean heat, i. 315—when copious every where fatal, i. 304.

Exocetus, the flying-fish, its description, v. 129.

Extraneous, or fossil shells, found in the bowels of the earth, v. 211.

Eyes, opened by the infant the moment of its birth, i. 336—particularly in them the passions are painted—different colours of the eye, whence they arise, 407—eyes of oxen are

brown; those of sheep of a water-colour; of goats are grey; and those of most white animals are red—distance between the eyes less in man than in any other animal, 409—in what circumstances women with child are said to be all mouth and eyes—the lower eye-lids, in women with child, drawn downwards, 426—of all parts the animal has double, the eyes produced soonest—privation of feeling and sight would misrepresent the situation and number of all things around us—two contribute to distinct and extensive vision—both eyes see round the object, and give it that heightened relief which no painting does attain to—in either is there a point which has no vision the defect is corrected by having the organ double—easy experiment to be convinced of it—objects at a distance are rarely equal in both eyes—the best eyes see objects largest—infants, having their eyes less, must see objects smaller in proportion—when we look at an object extremely brilliant, vision becomes indistinct, and why—how far the eye can accommodate itself to darkness—remarkable instance of it in a major under King Charles I. ii. 19—whence have arisen the small eyes of the Tartars and Chinese, 92—eastern poets compare the eyes of their mistresses to those of the gazelle—the Greeks resemble the eyes of a beautiful woman to those of a cow, ii. 276——of all animals, natives of this climate, none have an eye so beautiful as the stag, 305—that of the wolf opens slauntingly upwards, in the same direction with the nose, iii. 31—of the fox, placed obliquely, like those of the wolf, 44—those of the hare placed backwards, to see behind it as it runs, and these are never wholly closed, iii. 118——peculiar advantages of smallness of the eye in the mole, 192—description of the eyes of birds of the owl kind, in the eyes of all animals, a complete provision to shut out too much light, or to admit a sufficiency, by contraction and dilation of the pupil, iv. 106—those of the great Greenland whale not larger than those of an ox, v. 35——of the snail on the points of its largest horns, 214——peculiarities in the eyes of the cameleon, 321—eyes of the butterfly have not all the same form—the outward coat has a lustre displaying the various colours of the rainbow—examined a little closely, it will be found to have the appearance of a multiplying glass, vi. 70.

Eye-lashes, men and apes only have them upon the upper and lower lids—all other animals want them on the lower lid, i. 410.

Eye-lids, in birds and amphibious quadrupeds, the lower eye-lid alone has motion—fishes and insects have no eye-lids, i. 410.

F.

Falcon-gentle, a kind of hawk—it pursues the gazelles, ii. 288 ——many people admire its flesh, and dress it for eating, says Belonius. iv. 63—method of training up this bird—falconry, much disused among us, was a principal amusement of our ancestors—the falcon-gentle and the peregrine much less than the gyr-falcon, which exceeds all others in largeness—description of the gyr-falcon—a courageous and fierce bird, not fearing the eagle—it chiefly flies at the stork, the heron, and the crane—is chiefly found in the northern regions, but loses neither strength nor courage, when brought into the milder climates—the falcon-gentle moults in March, and sooner—the peregrine does not moult till August—the common falcon is of such spirit, that, like a conqueror in a country, he keeps all in awe and subjection to his prowess—young falcons, though depressed by captivity, will, when brought out, fly at barnacles and wild geese—the falcon's pursuit of the heron, kite, or woodlark, the most delightful sport—names of the falcons in use here, and in other countries—among the Welch, the king's falconer the fourth officer of the state; was forbid to take more than three draughts of beer from his horn, lest he should neglect his duty, iv. 89, &c.

Falconers catch the kite for the purposes of training the falcon, and how, iv. 113.

Fallopius, the two tubular vessels discovered by him, i. 358.

Famine supported by carnivorous animals for several weeks together, ii. 157.

Fat of the shammoy, its medicinal virtue—fat of animals found efficacious in some disorders, ii. 375——of the manati, exposed to the sun, has a fine smell and taste, and exceeds the fat of any sea-animal—the heat of the sun will not spoil it, nor make it rancid—several other qualities of this fat, iii. 270.

Father-lasher, description of this fish, v. 124

Fawn, name of the buck and the doe the first year, ii. 323.

Feathers of birds described, iv. 3——of the ostrich almost as soft as down, 38—different uses made of goose-feathers, 408.

Feather-beds utterly unknown in countries bordering on the Levant, and all Asia—ancients did not use feather-beds—Pliny speaks of bolsters of feathers for their heads—feathers make a considerable article of commerce—different qualities

—best method of curing them—old feathers more valuable than new, iv. 408.

Fecundity of the rabbit greater than of the hare, iii. 127.

Feeling, deprived of feeling, our eyes would misrepresent the situation and the number of all things around us, ii. 21—blind men have this sense finer than others, and why—the grossest and most useful of the senses—no total deprivation of it but with life—those parts most exercised in it acquire the greatest accuracy—the fingers, by habit, greater in the art than others, not from their having more nerves, 51—fishes having no organs for feeling, must be the most stupid of all animals—feeling, the guardian, the judge, and the examiner of all the senses, is never found to deceive, 51.

Ferret, not found at present here but in the domestic state—its description—a native of the torrid zone—naturally such an enemy of the rabbit, that a young ferret, although unacquainted with the kind, will fiercely attack and bite even a dead one—use of ferrets in warrens, to enter the holes muzzled, and drive the rabbits into the nets at the mouth—to bring the ferret from his hole, straw and other substances burnt at the mouth—the female less than the male, whom she seeks with great ardour, and often dies without being admitted—they sleep continually, and the instant they awake seem eager for food—are usually fed with bread and milk—breed twice a year—some devour their young as soon as brought forth, and then become fit for the male again—the litter usually from five to six young; and these consist of more females than males—its scent fœtid—has attacked and killed children in the cradle—is easily irritated, and then smells more offensively—its bite difficult of cure—has eight grinding teeth—to the ferret kind may be added an animal called by Mr. Buffon the vansire, iii. 80, &c.—originally from Africa, 132.

Fibres, muscular, compose the stomachs of insects, ii. 221.

Fieldfare, bird of the sparrow kind, iv. 246, 249.

Figure, little known exactly of the proportion of the human figure—different opinions concerning it, i. 427—whence proceed the variations in the human figure, ii. 92—the oldest measure of the human figure in the monument of Cheops, in the first pyramid of Egypt, 111.

Finder, a dog of the generous kind, iii. 13.

Fins, different purposes they answer in fishes, v. 3.

Fin-fish, v. 33—its food, 39.

Fingers, by habit, and not from a greater number of nerves, become exacter in the art of feeling than any other part, even where sensation is more delicate and fine, ii. 50.

Fire, perpetual, in the kingdom of Persia, i. 74—advantages arising from the subterranean fires, 104—put out by the sun shining upon it, and why, 276—great globe of fire seen at Bononia, in Italy, not less than a mile long, and half a mile

broad, 327—lighted to preserve herds and flocks from animals of the cat kind, ii. 399.

Fireflare, Pliny, Ælian, and Oppian, supply the weapon of this fish with a venom affecting even the inanimate creation—reasons to doubt of it, v. 84.

Fishes, petrified, found in the mountains of Castravan, i. 40—fish in abundance found in a new-formed island—those who eat of them died shortly after, 105—cannot live in water whence the air is exhausted, 261—showers of fishes raised in the air by tempests, 333—most of them produced from the egg, 366—have no eye-lids at all, 411—nor any neck, 423—having no organs for feeling, must be stupid, ii. 51—the ocean is the great receptacle of fishes—opinion that all fish are naturally of the salt element, and have mounted up into fresh water by accidental migration—some swim up rivers to deposit their spawn; of which the size is enormous, and the shoals endless—all keep to the sea, and would expire in fresh water—their pursuits, migrations, societies, antipathies, pleasures, times of gestation, and manner of bringing forth, are all hidden in the turbulent element that protects them—the chief instruments in the motion of a fish are the fins—in some they are more numerous than in others—it is not always the fish with the greatest number of fins that have the swiftest motion—how the fins assist the fish in rising or sinking, in turning or leaping out of the water—all this explained by the experiment of a carp put into a large vessel—all fishes covered with a slimy, glutinous matter, that defends their bodies from the immediate contact of the surrounding fluid—they fall behind terrestrial animals in their sensations—their sense of touching and smelling—their sense of tasting—hearing is found still more imperfect, if found at all—Mr. Gouan's experiment to this purpose—from it is learned they are as deaf as mute—their sense of seeing—their brain—their rapacity insatiable—when out of the water, and almost expiring, they greedily swallow the bait by which they are allured to destruction—the maw placed next the mouth; and though possessed of no sensible heat, is endued with a faculty of digestion, contrary to the system that the heat of the stomach is alone sufficient for digestion—though for ever prowling, can suffer want of food very long—instances of it, v. 1, &c.—life of a fish but one scene of hostility, violence, and evasion—the causes of annual migrations—all stand in need of air for support—those of the whale kind come to the surface of the sea every two or three minutes, to breathe fresh air—experiment of a carp in a large vase of water, placed under an air pump—general method of explaining respiration in fishes, the description and uses of their air bladder—full play of the gills prevented, or the bony covers kept from moving, the animal would fall into convulsions, and die—some fishes have no air-bladder—can live but

a few minutes without air—Bacon's observations upon their growth and age—two methods for determining the age of fishes, more ingenious than certain—a carp found to be an hundred years old—the discovery confirmed by authors—longevity of these animals, nothing compared to their fecundity—some multiply by millions—some bring forth their young alive, and some produce eggs—the former rather the least fruitful—the viviparous blenny brings forth two or three hundred at a time, all alive, and playing together round the parent, 12—the flesh of fishes—question to the learned concerning the flesh of fishes, 25—cetaceous fishes, 26—cartilaginous fishes, 63—spinous fishes, 117—Mr. Gouan's system of spinous fishes, 119—all fish of the same kind have the same number of bones—the small, lean, and with many fins, the most bony—vulgar expression, that fishes at some seasons are more bony than at others, scarce deserves contradiction—none imbibe the sea-saltness with their food, or in respiration—whence then do some fishes live there, and quickly expire in fresh water—some fish, as the eel, descend the fresh-water stream to bring forth their young in the sea—in what season—long voyages undertaken by some tribes that constantly reside in the ocean, and may be called fish of passage—stated returns and regular progress of these fish of passage the most extraordinary circumstances in the history of nature—names of several migrating fishes—of all such, the herring and pilchard take the most adventurous voyages—places where found in abundance, 132—amazing propagation along our coasts and rivers, not proportionate to the quantities among the islands of the Indian Ocean—places where the spawn is deposited—doubts whether most fish come from the egg completely formed—growth of fishes—instance in the growth of the mackarel—all live upon each other in some state of their existence—of those in the ocean, of the spinous kinds, the dorado the most voracious—flying-fish chiefly sought by the dorado—their warfare—opinion that all fishes are natives of the sea, founded upon their superior fecundity of breeding twenty to one—certainly fresh-water fishes abate of their courage and rapacity—greediness of the sea-fish to devour the bait prodigious, compared with the manner it is taken in fresh-water—some fishes rendered so torpid in the northern rivers as to be frozen up in the masses of ice, and continue there several months, seemingly without life or sensation, waiting the approach of a warmer sun to restore them to life and liberty—each species of fish infested with worms of different kinds—most vivacious animals—often live upon substances poisonous to the more perfect classes of animated nature—numbers of fishes making poisonous wounds, scarcely to be doubted—some fishes being poisonous is notorious, the cause inscrutable—the Philosophical Transactions give an account of poisonous qualities of fish, at

New Providence—all kinds, at different times, alike dangerous; the same species this day serving as nourishment, the next found fatal—speculations and conjectures to which these poisonous qualities have given rise, 144, &c.

File-fish, most wonderful of the shelly tribe, v. 250. See *Pholas*.

Fishery of pearls, several—chiefly carried on in the Persian Gulph—the people destined for the pearl fisheries—they die consumptive—in what manner they fish for pearls, v. 244.

Fishing-frog, from its deformity called *sea-devil*—conceit that this fish uses its two long beards, or filaments, for fishing—Rondelet says, that the bowels taken out, the body appears transparent; and, with a lighted candle in it, has a formidable appearance—fishermen have a great regard for this ugly fish, as an enemy to the dog-fish—when taken they set it at liberty, v. 106.

Fissures, perpendicular, found in every field, and every quarry—their causes, i. 54.

Fistularia, description of this fish, v. 128.

Flame will burn under water—none found continuing to burn without air, i. 276.

Flamingo, the most remarkable of the crane kind; the tallest, bulkiest, and most beautiful—its description—chiefly found in America—once known on all the coasts of Europe—in deserted regions the flamingos live in a state of society, and under a better polity than others of the feathered creation—delicacy of its flesh—when the first Europeans in America killed one the rest regarded the fall in fixed astonishment; thus the fowler levelled the flock, before any began to escape—it is now one of the scarcest and shyest birds in the world—places it chiefly inhabits—always appoint one as a watch, who gives notice of danger with a voice as shrill as a trumpet—Negroes fond of their company, and think their society a gift from heaven, and protection from evils—those killed hidden in the long grass, to prevent ill treatment from the blacks discovering the murder of their sacred birds—are frequently taken with nets—refuse all nourishment, when taken; pine and die, if left to themselves in captivity—its tongue is the most celebrated delicacy; a dish of them, says Labat, is a feast for an Emperor—a Roman Emperor had fifteen hundred flamingo's tongues served up in a dish—their tongue larger than that of any other bird—its flesh—they move in rank like cranes—appear in flight of a bright red as a burning coal—manner of feeding very singular—savages of Canada call it *tococo*, and why—time of breeding, and their nests—number of their eggs—colour when young—then become familiar in five or six days, eat out of the hand, and drink sea-water; but generally pine away, wanting their natural supplies, and die in a short time—savages make ornaments of their plumes; and the skin sometimes serves the Europeans to make muffs, iv. 322.

Flea can draw a chain a hundred times heavier than itself, and eat ten times its own size of provision in one day, v. 396—its description, 411—arborescent water flea, or monoculus, described, 427—Leuwenhoeck has discovered above six thousand facets on the cornea of a flea, vi. 70.

Flemings, possessed the art of cloth-working in a superior degree —were invited to settle here, ii. 253.

Flesh, dries at Cusco like wood, without corrupting, ii. 119—the Persians esteem that of the wild ass so highly that its delicacy is a proverb among them, 200—of the fallow deer preferred to any other, 321—of the roe-buck, between one and two years old, allowed the greatest delicacy known, 332—of the tiger is good for food; some hold it superior to mutton, 422—of dogs, sold in shambles all over China; and the negroes of the coasts of Guinea esteem it a delicacy, as likewise that of toads, lizards, and tigers, iii. 23—that of the wolf very indifferent; no creature known to eat it but the wolf himself, 43—of the squash, tolerable food, 102—that of the glutton not fit to be eaten, 115——of the hare, religiously abstained from by Jews, ancient Britons, and Mahometans, 126—of the paca, considered a great delicacy, 159—of the tendrac, thought by the Indians a great delicacy, 202—of the pangolin, considered a very great delicacy by the negroes of Africa, 216—of the armadilla, or tatou, said to be delicate eating, 223—of the seal, formerly found place at the tables of the great, 265—of the monkey, liked by the negroes, 305—of the ostrich, proscribed in Scripture, unfit to be eaten, iv. 40—of the emu, or the American ostrich, good to be eaten, 51—of the dodo, good and wholesome eating, 58—of the vulture, falcon, and osprey, when young, excellent food, according to Belonius—that of carnivorous birds stringy and ill tasted, soon corrupted, and tinctured with that animal food upon which they subsist, 63—of the bird condor, as disagreeable as carrion, 74—of the peacock, keeps longer unputrefied than of any other animal, 134—of the pheasant, considered as the greatest dainty—of the quail, a very great delicacy, 163—that of the partridge, so valued by the French, according to Willughby, that no feast could be complete without it, 157—of the toucan, tender and nourishing, 190—of young herons, in particular estimation in France, 314—of the bittern, greatly esteemed among the luxurious, 319—of the puffin, formerly by the church allowed on lenten days, 393—of fishes, yields little nourishment, v. 25—of the young porpoise, said to be as well tasted as veal, 58—of the shark, is hardly digestible by any but negroes, who are fond of it to distraction, 75—of the turtle, is become a branch of commerce, 194—that of some crabs is poisonous, 177—of the great Mediterranean turtle sometimes poisonous, 190.

Flies torment the elephant unceasingly—arts the elephant tries

to keep them off, iii. 243——dragon-fly, or the libella, vi. 2—common water-fly, swims on its back, 35—the cornea adapted by Puget, as to see objects through it with a microscope—strangeness of its representations—does the fly see object singly, as with one eye; or is every facet a complete eye, exhibiting its object distinct from the rest, 70——the Spanish fly, vi. 152. See *Cantharides*.

Flintshire, in a lead mine there, two great grinding teeth, and part of the tusk of an elephant, discovered, at the depth of forty-two yards, iii. 356.

Flounder, known to produce, in one season, above one million of eggs, v. 21.

Fluids, ascending in vessels emptied of air—rising in capillary tubes, and how this comes to pass, i. 161.

Flumide, description of this fish, vi. 284.

Flux of the sea, i. 209—not equal in the Streight of Magellan, 216.

Fly-catcher, bird of the sparrow kind, iv. 249.

Flying-fish, its description, v. 129.

Flying-squirrel described, iii. 144.

Fly-trap, name of a flower, closing upon the flies that light upon it, vi. 170.

Fœtus, the canal of communication through which the blood circulates in the fœtus, without going through the lungs, has been found open in some bodies that have been dissected, v. 246.

Fongwhang, natives of China give a fantastic description of this imaginary bird, iv. 147.

Fontenelle, a celebrated writer, of a weak and delicate habit of body; the remarkable equality of his temper lengthened out his life to above an hundred—nothing could vex or make him uneasy, ii. 63.

Food, man can live without it for seven days—a Scotchman, for the space of six weeks, took no food at all, ii. 9.

Foramen-ovale, opening in the heart of the fœtus, i. 380——in the seal's heart never closes, iii. 358.

Form of hares made in places where the colour of the grass most resembles that of their skin; is open to the south in winter, and to the north in summer, iii. 122—they sleep or repose in them by day, 121.

Formica-leo, the *lion-ant*, described—its habits—retreat—contrivances for catching other insects—when attaining a certain age changes its form—description, when become a large and beautiful fly of the libellula kind, vi. 7.

Fossil, teeth of elephants often found in that state—bones found in Peru and Brasil, iii. 356—shells in the bowels of the earth, not found in the ocean, v. 211.

Fouine, animal of the weasel kind, iii. 88.

Fowls, large, do not rise easily, and why, iv. 6.—few water-fowls known to breed in England, and why, 25—those of reddish

plumage the ancients held invaluable; the white as unfit for domestic purposes, and fit as prey to rapacious birds—Aristotle thinks them less fruitful than the former, 125—general characteristics of water-fowls—their food—the gull kind—the penguin kind—the goose kind, 349—water-fowls properly of no climate, 394.

Foxes hunt in packs, iii. 6.—their cubs born blind, like those of the dog—the fox lives about twelve or fourteen years—remarkable instance of parental affection of a she fox—all animals make war upon the fox—even the birds—refuses to engender with the dog—brings forth fewer than the dog, and but once a year—the female goes with young six weeks, and seldom stirs out while pregnant—various colours of them—three varieties of this animal in Great Britain; greyhound-fox, mastiff-fox, and cur-fox—round the pole they are all colours—jackall taken for the fox—skin of the black fox most esteemed, a single skin selling for forty or fifty crowns, 44, &c.—in Greenland do not change colour at all, 78—taken young, are gentle only while cubs; growing older, discover their natural appetites of rapine and cruelty, 7—nothing eatable comes amiss to them, rats, mice, serpents, toads, and lizards; insects, crabs, shrimps, and shell-fish; carrots, wax, and honey; even the hedge-hog, 47—chace of the fox—their offensive smell often the cause of their death—way they find to subsist—name given by huntsmen to a fox of the second year—old fox the name for the third year, 47—many animals in this country bred between a dog and a fox—experiments prove neither the wolf nor the fox of the same nature with the dog, each a species perfectly distinct, 24—exactly resembles the wolf and the dog internally, 44—description—eyes obliquely situated, like the wolf, 44——often takes possession of the hole quitted by the badger, or forces it from its retreat by art, 391.

Fox, (crost) name of the *isatis*, when turning white, iii. 62.

Fox-tailed-monkey, of the sagoin kind, iii. 316.

Fray, said when stags rub off the peel of their horns against trees, ii. 312.

Frog, designedly introduced into Ireland before the Norway rat—the rat put a stop to their increase, and the frog is almost extinct in that kingdom, iii. 169—differences between it and the toad in figure and conformation, v. 257—the frog the best swimmer of all four-footed animals—its description—how the female brings forth eggs—various changes in the eggs, after impregnation by the male—the animal in its perfect state, from feeding upon vegetables, becomes carnivorous, lives upon worms and insects, and seeks for food upon land—myriads seen on such occasions, have been fancied to be generated in the clouds, and showered down on earth—their habitudes and food—differences of sexes not perceivable until their fourth year—do not begin to propagate till that period—live about

twelve years—a German surgeon kept one eight years in a glass covered with a net; fed it often, but sparingly—instances of tenaciousness of life—the male only croaks—large water-frog's note as loud as the bellowing of a bull, and heard at three miles distance—times of their croaking—no weather-glass so true in foretelling changes—adhere to the backs of fishes—story of Walton to this purpose—dry weather hurtful to frogs, v. 258. See *Fishing-frog*.

Frost-smoke, fogs near the pole from halos, or luminous circles, i. 331.

Froth-worm, its description, vi. 34.

Fur, the colder the country the larger and warmer the fur—instances of it, ii. 161——of the white fox not esteemed, and why, iii. 51—the isatis of no value, unless killed in winter, 62—the ermine the most valuable of any, 76—no easy matter to account for warmth of furs of northern quadrupeds, or how they come to have such abundant covering—particulars on this subject, 77—white weasel, found in Great Britain, of no value—ermine, in every country changes by time, 80—of the pole-cat, in less estimation than some of inferior kinds, 86—of the yellow-breasted martin, more valuable and beautiful than the white, 89—different colours of the sable, 92—of the genette, valuable, 104—of the civet, impregnated with the perfume, 107—of the glutton, has the most beautiful lustre, and is preferred to all, except the Siberian sable, 115—of the hare, forms a considerable article in the hat manufacture, 125——of the cricetus, or German rat, very valuable, 184—inside down of the vulture's wing makes a warm and comfortable kind of fur, iv. 83.

Fury, a small worm in Finland, which enters into the flesh, and occasions dangerous inflammations, vi. 179.

G.

Gadfly described, vi. 164.

Gadus, the cod-fish, its description, v. 127.

Gall of the shammois held useful to strengthen the sight, ii. 274—the deer kind have none, 296.

Gall-nuts, description of the insect forming and residing in them, and its transformations, vi. 157.

Galley-fish, its description—its legs adhesive—common in America, perpetually floating—no efforts made to hurt can make it sink—never perceived to move on shore, so strongly adhering to whatever substances applied—the smallest quantity of slimy substance from its legs burns the skin like hot oil—the shore covered with them a fore-runner of a storm, v. 112.

Galley-worm, its difference from the scolopendra, v. 438.

Ganges, a river visited annually by a hundred thousand pilgrims, who pay their devotions to it as to God, i. 176—in its course receives twenty rivers, 183.

Gannet, the Soland goose, its description—subsists upon fish—places abounding with them—manner of preserving them and their eggs, in the island of St. Kilda—twenty-three thousand of this kind of young bird consumed annually there—a bird of passage—its migrations—never comes near the land—where seen, it announces the arrival of herrings—exceeds the cormorant in quickness of sight—method of taking its prey—manner of taking them at sea—number of their eggs—the young counted a great dainty, and sold very dear, iv. 368.

Garter-fish, the lipidopus, its description, v. 128.

Gasterosteus, or the Stickleback, description of this fish, v. 125.

Gaze-hound hunts by the eye, iii. 25.

Gazelles, neither goat nor deer—partake of both natures—they form a distinct kind—their description—of all animals it has the most beautiful eye—eastern poets compare the eyes of their mistresses to those of the gazelle—Buffon makes but twelve varieties—their names and descriptions, ii. 276——comparing them together, we find but slight distinctions—are inhabitants of the warmer climates—no animals, but of the winged kind, can overtake them—are pursued by falcons; and this hunting is a principal amusement among the great in the East—also hunted with the ounce—another way of taking them—keep in solitary and inaccessible places, 287—the bubalus, more properly one of Africa, 340—the most usual prey for the lion in deserts and forests—the prey of the panther, 400—pursued by the jackall makes towards houses and towns, iii. 58.

Gekko, a kind of salamander, v. 311.

Generation, most complete where fewest animals are produced, i. 382.

Genette, its odour more faint than civet—description of this animal—resembles the martin; more easily tamed—Belonius has seen them at Constantinople tame as cats—glands open differently from others of its kind—called the cat of Constantinople—never found in mountains, or dry places—its fur valuable—species not much diffused—countries where it is found—the most beautiful, cleanly, and industrious animal—keeps a house free from mice and rats by its smell, iii. 102, &c.

Georgians, their description, ii. 85.

Gerenda, a serpent to which the natives of Calicut, and those of the Mozambique coast, pay divine honours, v. 378.

Gesner minutely describes a variety of mice-traps, iii. 175—places bats among birds, 226.

Giant, in England, as late as King James I. the court had one, ii. 101.
Giants, probability of the race affirmed, possibility of their existence denied—Grew's opinion—Ferdinand Magellan, a Portuguese, first discovered a race of such people, towards the extreme coast of South America—assent to the existence of this gigantic race of mankind—travellers confirm it—seen here, have the same defects of understanding as dwarfs—are heavy, phlegmatic, stupid, and inclined to sadness, ii. 106.
Gibbon, the long-armed ape, its description, iii. 291.
Gills, their free play prevented, the animal falls into convulsions, and dies, v. 16.
Gilthead, called dolphin by sailors—its description, v. 122.
Glands, furnish the fœtid substance in animals of the weasel kind, iii. 73—of the genette, open differently from others, 103—unctuous in birds, to preserve their feathers, iv. 3—salivary in the gullet and crop of birds, 12.
Glitters, little impressions so called in the heads of stags, ii. 312.
Globe of fire rising from the side of the mountain Pichinca—a great one seen at Bononia, in Italy, in the year 1676—past westward at a rate of a hundred and sixty miles in a minute—could not be less than a mile long, and half a mile broad, i. 326.
Globe of glass, filled with water, assumes successively all the colours of the rainbow, i. 329.
Gloucester, its corporation had an old custom annually to present the king with a lamprey pye, v. 97.
Glow-worm, male and female of this species differ entirely from each other—how and in what manner light sent forth by the glow-worm is produced, hitherto inexplicable—the light continues to grow paler, and at last is totally extinct, if the worm be kept for some time, vi. 151.
Glue, made of the horns of the rein-deer, ii. 354—Mr. Jackson found out a method of making glue to answer the purposes of isinglass, v. 104.
Glutton, the most dangerous and most successful persecutor of the rein-deer—its manner of killing that deer, ii. 356—belongs to the weasel kind—there is no precise description of it; some resembling it to a badger, some to a fox, others to a hyæna—one brought alive from Siberia was three feet long, and about a foot aad a half high—so called from its voracious appetite—countries where found—called *carcajou* in North America—general description—Ray and others doubt of its existence—takes its prey by surprize, and in what manner—darts down from branches of trees upon the elk, or the rein-deer, sticks its claws between their shoulders, and remains there firm, eating their necks, and digging to the

great blood-vessels that lie on that part—amazing quantity one of these animals can eat at a time; that seen by Mr. Klein, without exercise or air, taken from its native climate, and enjoying but indifferent health, eat thirteen pounds of flesh every day, and was not satisfied—it continues eating and sleeping, till its prey, bones and all, be devoured—prefers putrid flesh to that newly killed—it is so slow, that any quadruped can escape it, except the beaver—pursues it upon land; but the beaver taking water the glutton has no chance to succeed—called the vulture of the quadrupeds—in what manner it makes up by stratagem the defects of nature—the female goes with young four months, and brings forth two or three—the male and female equally resolute in defence of their young—is difficult to be skinned—does not fear man—is a solitary animal, and never in company but with its female—couples in the midst of winter—the flesh not fit to be eaten—the fur has the most beautiful lustre, and preferred to all, except the Siberian fox, or the sable, iii. 109, &c.

Gnats, proceed from a little worm, usually seen at the bottom of standing waters—curious manner in which the eggs are laid—in their egg state it resembles a buoy, fixed by an anchor—different states of the insect—in its last transformation, divested of a second skin; in the next it resigns its eyes, its antennæ, and its tail, and seems to expire—from the spoils of the amphibious animal appears a little winged insect, whose structure is an object of admiration—description of this insect, and of its trunk, justly deemed one of nature's masterpieces—implement with which the gnat performs its work in summer—places where it spends the winter—the little brood so numerous, that the water is tinged with the colour of the species—some gnats oviparous, others viviparous, and come forth in a perfect form; some are males, and unite with the female; some are females, requiring the male; others are of neither sex, and produce young without copulation—at the sixth generation their propagation stops, the gnat no longer reproduces its likeness, but requires the male to renew its fecundity—produced in multitudes beyond expression in America; and found of all sizes, from six inches long, to a minuteness beyond the perception of the common eye—native Indians, anointed with oil, sleep in cottages covered with thousands of gnats, and have not their slumbers interrupted by these cruel devourers, vi. 159.

Goat, its eyes are grey, i. 409—from Europe imported into South America soon degenerates—as it grows less, it becomes more prolific—imported to the African coast, it seems to improve, ii. 165——goat and sheep propagate together; and may be considered as of one family—the buck-goat produces with the ewe an animal, in two or three generations

returning to the sheep, and retaining no marks of its ancient progenitor, 246—more fitted for a life of savage liberty than the sheep—is not easily confined to its flock, but chuses its own pasture, and loves to stray from the rest—delights in climbing precipices—is capricious and vagrant—is not terrified at storms, or incommoded by rain—immoderate cold affects it, and produces a vertigo, to which this animal is subject—proof of its being naturally the friend of man, and that it seldom resumes its forest wildness, when once reduced into the state of servitude—in some places they bear twice a year—in warmer climates generally bring forth three, four, and five, at once—milk of goats medicinal; not apt to curdle in the stomach—flesh of the goat, properly prepared, ranked by some not inferior to venison—is never so good and so sweet, in our climate, as mutton—no man can attend above fifty goats at a time—flesh of the goat found to improve between the tropics—remarkable varieties in this kind—that of Natolia, by Mr. Buffon called *goat of Angora*—its description—the *Assyrian goat*, of Gesner—chiefly kept about Aleppo—*little goat of America*, the size of a kid; has hair as long as the ordinary breed—*Juda goat*, not larger than a hare—common in Guinea, Angola, and the coast of Africa—*blue goat*, at the Cape of Good Hope—its description, 260—boundaries between the goat and deer kind difficult to fix—*Bezoar goat*, the *pasan*, found in the mountains of Egypt, &c. 280—*African wild goat* of Grimmius, fourth anomalous of the kind—its description, 286—goats eat four hundred and forty-nine plants, and reject a hundred and twenty-six, 362—in Syria, remarkable for their fine glossy, long, soft hair, 391.

Goat-sucker, a nocturnal swallow—description and habits, iv. 270.

Gobius, the gudgeon, description of this fish, v. 123.

Godwit, its dimensions, iv. 332—a bird of passage, 336.

Gold, never contracts rust, and why—except in places where much salt is used, i. 259.

Golden-eye, bird of the duck kind, iv. 411.

Goldfinch, bird of the sparrow kind, iv. 247—learns a song from the nightingale, 270.

Goose, marks of the goose kind,—food—abstained from by the ancients, as indigestible, iv. 395—one known to live a hundred years, 404—marks of the tame and wild sort—wild supposed to breed in the northern parts of Europe—flight regularly arranged, 405.

Goose, (Brent) most harmless, but for their young pursue dogs and men—use of its feathers in beds unknown in countries of the Levant and Asia—feathers a considerable article of commerce—different qualities of them—the best method of curing them, iv. 406.

Goose, (Soland) described, iv. 368. See *Gannet*.
Gooseander, a round-billed water-fowl, its description—feeds upon fish, iv. 395.
Gordius, or *Hair-worm*, described, vi. 178.
Gossamere-spider, account of, v. 410.
Goss-hawk, of the baser race of hawks, iv. 91—taught to fly at game—little obtained from its efforts, 99.
Gounan, his system of fishes deserves applause for more than its novelty—how followed in arranging the spinous class of fishes, v. 119.
Grampus, fierce and desperate in defence of its young—remarkable instance, v. 29—description and habits, 54.
Grasshopper, differences between ours and the *cicada* of the ancients—great varieties of this animal in shape and colour—description of the little grasshopper, that breeds plentifully in meadows, and continues chirping through the summer——the male of this tribe only vocal—how their fecundation is performed—the male or female never survive the winter—their eggs—from first appearing, possessed of wings—how it gets rid of the outer skin—their food—places where they deposit their eggs, vi. 13.
Grave, the greatest care recommended not to commit those dearest to us to the grave, before real signs of certain death be ascertained, ii. 70.
Greatah, river in Yorkshire running under ground, and rising again, i. 188.
Grebe, description of this bird—residence, and habits; perpetually diving, and very difficult to be shot—never seen on land—chiefly sought for the skin of its breast, and why—in breeding-time their breasts are bare, iv. 344.
Greenfinch, bird of the sparrow-kind, iv. 247.
Greenland, Krantz's account of the formation of ice-mountains in that country, i. 205—*aurora borealis*, its appearance almost constant in winter—the inhabitants not entirely forsaken in the midst of their tedious night; this *aurora* affording them light for the purposes of existence, 331—they live mostly upon seals—their number daily diminishing, and why, iii. 267.
Greenlanders, described, ii. 72—customary among them to turn Europeans into ridicule—a quiet, or a modest stranger, they deem almost as well bred as a Greenlander, 74.
Green-shank, a kind of crane, iv. 332.
Greyhound kind, iii. 15—*Greyhound-fox*, 51.
Grossbeak, bird of the sparrow-kind, iv. 247.
Grotto of Antiparos, in the Archipelago, the most remarkable subterraneous cavern now known—description, i. 58.
Grotto del Cane, near Naples, situation and description—noxious effects, i. 72.
Grous, chiefly found in heathy mountains and piny forests, iv. 152.

Growth of the child less every year, till the time of puberty, when it starts up of a sudden, iv. 332—growth of the mind in children corresponds with that of the body, and why, i. 392, —of some young people ceases at fourteen, or fifteen; in others continues till two or three-and-twenty, 406—of fishes, irregular and tardy, v. 148.

Guanacoes, a kind of camel in America, iii. 382.

Guanches, ancient inhabitants of the island of Teneriffe—art of embalming still preserved among them when the Spaniards conquered the island, ii. 117.

Guariba, Brasilian guariba, or warine, the largest of the monkey kind in America, described, iii. 314.

Gudgeon, description of that fish, v. 123.

Guiba, animal resembling the gazelle—its description, ii. 285.

Guillemot, bird of the smaller tribe of the penguin kind, iv. 389.

Guinea-ass, larger and more beautiful than the horse, ii. 207.

Guinea-hen, described, iv. 147.

Guinea-horse, remarkable sports with it among the grandees of that country, ii. 190.

Guinea-pig, by Brisson placed among the rabbit kind—native of the warmer climates—rendered domestic, and now become common every where—its description—in some places a principle favourite; often displacing the lap-dog—manner of living among us—most helpless and inoffensive, scarce possessed of any courage—their animosity exerted against each other; often fighting obstinately, and the stronger destroys the weaker no natural instinct; the female sees her young destroyed, without attempting to protect them—suffer themselves to be devoured by cats—fed upon recent vegetables they seldom drink—sometimes gnaw clothes, paper, or other things of the kind—drink by lapping—confined in a room seldom cross, the floor, but keep along the wall—never move a-breast together—chiefly seek the most intricate retreats, and venture out only when all interruption is removed, like the rabbits—in cold weather more active—a very cleanly animal—their place must be regularly cleaned, and a new bed of hay provided for them once a week—the young falling into the dirt, or other ways discomposed, the female takes an aversion to them, and never permits them to visit her more—her employment, and that of the male, consists in smoothing their skins, disposing their hair, and improving its gloss; and take this office by turns—do the same to their young, and bite them when refractory—reared without artificial heat—no keeping them from fire in winter, if once permitted to approach it—manner of sleeping—the male and the female watch one another by turns—generally capable of coupling at six weeks old—time of their gestation—the female brings forth from three to five at a time; not without pain—suckles

her young about twelve or fifteen days; and suffers the young of others, though older, to drain her, to the disadvantage of her own—produced with eyes open, and in twelve hours equal to the dam in agility—capable of feeding upon vegetables from the beginning—their disputes for the warmest place, or most agreeable food—manner of fighting—flesh indifferent food—difficultly tamed—suffer no approaches but of the person who breeds them—manner of eating—drink seldom, and make water often—grunt like a young pig—appear to chew the cud, iii. 161, &c.

Guinea-sheep, have a kind of dewlap under the chin—breed with other sheep, therefore not animals of another kind, ii. 257.

Guinea-worm, described, vi. 179.

Gull, places where found in plenty—their food, iv. 372.

Gulls, various ways of imposing upon each other—contests in breeding—residence, with their nests and eggs—their flesh—method of taking them in the Feroe islands—anciently a law in Norway concerning those who died in taking them, iv. 376.

Gun, wind-gun, instrument determining the elasticity of the air—a ball from it pierces a thick board, i. 254—great guns, in climates near the equator, with every precaution, after some years, become useless, and why, 258.

Gunpowder, readily fires with a spark, not with the flame, i. 71. —will not go off in an exhausted receiver—a train of gunpowder laid, one part in open air, the other part in vacuo, the latter will remain untouched, 276.

Gurnard, description of this fish, v. 124.

Gymnotus, the *carapo*, description of this fish, v. 126.

Gyr-falcon, exceeds all others in largeness of size—its description, iv. 91.

Gyrle, name given by hunters to the roe-buck, the second year, ii. 330.

H.

Haddock, a periodical shoal appeared on the Yorkshire coasts, on December 10, 1766, and exactly on the same day in the following year, v. 138.

Hæmorrhois, a kind of serpent, v. 369.

Hail, Cartesians say, is a frozen cloud, half melted and frozen again in its descent—the most injurious meteor known in our climate—hail-stones fourteen inches round—struck out an eye of a young man, and killed him on the spot—a dreadful shower, recorded by Mezeray, fell in 1510; the hail-stones were of a bluish colour, and some weighed an hundred

pounds—the fishes were great sufferers in that general calamity, i. 318.

Hair of the Roman ladies praised for the redness of its shade, i. 403—found most different in different climates—marks the country and the disposition of the man—by the ancients held a sort of excrement, produced like the nails—according to moderns, every hair lives, receives nutriment, fills, and distends, like other parts of the body—takes colour from the juices flowing through it—each, viewed with a microscope, consists of five or six lesser, wrapped up in one common covering, and sends forth branches at the joints—suitable to the size or shape of the pore through which it issues—bulbous at the root, and its end resembles a brush—length and strength of hair a mark of a good constitution—Americans and the Asiatics have it thick, black, strait, and shining—inhabitants of the torrid climates of Africa have it black, short, and woolly—the people of Scandinavia have it red, long, and curled—opinion that every man has dispositions resembling those of the inhabitants of countries he resembles in the colour and nature of his hair—curled hair among us a beauty—the Greeks have taken one of their national distinctions from the length and straitness of the hair—Americans take the greatest pains in cutting their hair—variety in customs and manner of cutting hair, 411—trade of the inhabitants of Angora with the hair of animals of their country—camblet and other stuffs made of it, ii. 265—hair of the cat rubbed in the dark sends forth shining sparks, 387—Syria and Persia noted for long soft hair to the animals bred in them, 390—each hair of the lynx is of three different colours, 429—of the black fox, so disposed as impossible to tell which way the grain lies, iii. 51—coats of hair seem to thicken at the approach of winter—among quadrupeds as among men, thin spare diet produces hair, 77—on the soles of the feet, and on the insides of the mouths of hares, iii. 122.

Hair-worm supposed to produce a whitlow by its bite, vi.

Halcyon, rapacious water-fowl, iv. 423. See *King-fisher.*

Halley, (Dr.) observes spring-water is collected from the air itself, i. 142—his opinion concerning the origin of rivers, 163, 166—says it may be taken for a general rule, that the largest and highest mountains supply the greatest and most extensive rivers, 174—his method of finding out the age of the world by the saltness of the sea, 197—improved the diving-bell, he could write or read in it at the bottom of the sea, when the water was clear, especially when the sun shone—observed one thing very remarkable, that the water, which from above is usually seen of a green colour, when looked at from below, appeared of a very different one, casting a redness

upon his hands, like that of damask-roses, 241—his theory to explain the invariable motion of the winds, 283.

Halos, oftener seen in countries near the poles than any other part of the earth, i. 331.

Hammer, (the yellow) a bird of the sparrow kind, iv. 247.

Hamster, the cricetus, or German rat of Buffon, iii. 181.

Hand, sufficient to vindicate the dominion of man over other animals, a poor assertion—a man, without hands or legs, converts his stumps to most convenient purposes, and performs astonishing feats of dexterity, iii. 328.

Harbour of a stag, in covert or thicket, ii. 311, 312.

Hare, a gregarious animal, where it has no enemies but beasts of the forest, ii. 217—the swiftest animal for the time it continues to run—animals of the hare kind inoffensive and timorous—placed by Pyerius among those that chew the cud—whether or not, certainly the lips continually move, sleeping or waking—if not thinned by constant depredations, would over-run the earth—of these the hare the largest and most timorous—has large prominent eyes, placed backwards, to see behind as it runs—these never closed; it sleeps with them open—the ears moveable, and capable of direction to every quarter—muscles of its body strong, and without fat—hinder feet longer than the fore, on account of speed—prosecuted by dogs, cats, weasels, and birds of prey—in a state of engendering very early—females go with young thirty days, and bring forth three or four at a time—has young of different ages in her womb together—the young brought forth with their eyes open—the dam suckles them twenty days—food they are fond of—sleep or repose in their form by day, and live only by night—the rutting season begins in February—the male pursues and discovers the female by the sagacity of its nose—the slightest breeze, or falling of a leaf, disturbs their revels; they instantly fly off, each taking a separate way—are more easily taken than the fox; a much slower animal than they, and why—always chuse to run up hill, and why—have the sole of the foot furnished with hair, and seem the only animals with hair on the inside of the mouth—live seven or eight years, and come to perfection in one year—females live longer—Mr. Buffon makes a doubt of it—seldom heard to cry, except when seized or wounded—their cry nearly like the squalling of a child—are easily tamed—though never so young, regain their native freedom at the first opportunity—have a good ear, and been taught to beat the drum, dance to measure, and go through manual exercise—make themselves a form where the colour of the grass resembles that of their skin, open to the south in winter, and to the north in summer—sore hunted, will start a fresh hare, and squat in its form—some enter holes like the rabbit, by hunters termed

going to vault—as it tires, treads heavier, and its scent is stronger—young hares tread heavier than old—male makes doublings of greater compass than the female—divided by hunters into mountain and measled hares—mode of expression, the more you hunt, the more hares you shall have, and why—what animals persecute the hare—its enemies so various, that it seldom reaches the short term limited by nature—in countries near the North Pole, they become white, and are often in great troops of four or five hundred—their skins sold for less than seven shillings a hundred—the fur known to form a considerable article in the hat manufacture—found also entirely black, in much less quantity than the former—some have been seen with horns, but rarely—those in hot countries smaller than ours—those in the Milanese the best in Europe—scarce a country where not found, from the torrid zone to the polar circle—natives of Guinea kill numbers at a time; in what manner—the Jews, ancient Britons, and Mahometans, all considered it as an unclean animal, and religiously abstained from it—hare and rabbit distinct kinds—refuse to mix with each other—an instance—laws made for the preservation of them, iii, 116, &c.

Harfang, or Great Hudson's-Bay owl, the largest of the nocturnal tribe, iv. 109.

Harlequin, a kind of dog, iii. 14, 17.

Harpies, that ancient idea taken from the rousette, or the great bat of Madagascar, iii. 233.

Harrier, hound, and beagle, all of the same kind, iii. 12—a dog of the generous kind, 13—used for hunting, 14.

Hart, name of the stag the sixth year, ii. 311.

Hartshorn and musk, the only medicines of reputation of several procurable from quadrupeds, ii. 375.

Harvey, his opinion about the formation of the incipient animal—altercations against his system, i. 358.

Hatching, nothing exceeds the patience of birds hatching—Mr. Addison's observations to this purpose, iv. 21—the emu very peculiar in the hatching of its young, 50—the crocodile's eggs hatched in the sand, v. 305.

Hawfinch, a bird of the sparrow kind, iv. 249.

Hawk kind—hawk destroys mice, iii. 174——perceives a lark at a distance which neither men nor dogs could spy, iv. 8——distinctive marks from other carnivorous birds, 64—in old paintings, the criterion of nobility; no person of rank stirred out without his hawk on his hand—Harold, afterwards King of England, going on an important embassy into Normandy, is drawn, in an old bas-relief, embarking with a hawk on his fist, and a dog under his arm—in those days, it was sufficient for noblemen's sons to wind the horn, and carry the hawk fair—this diversion in such high esteem among the great all over Europe, that Frederick, Emperor of Germany, wrote a

treatise upon hawking—this amusement now much given over in this kingdom, and why—in the reign of James I. Sir Thomas Monson gave a thousand pounds for a cast of hawks—in the reign of Edward III. it was made felony to steal a hawk—to take its eggs was punished by imprisonment for a year and a day, with a fine at the king's pleasure—in the reign of Elizabeth, the imprisonment reduced to three months, the offender to lie in prison till he got security for his good behaviour during seven years—in earlier times, the art of gunning was but little used, and the hawk was then valuable for its affording diversion, and procuring delicacies for the table, not otherwise to be obtained—distinctive marks of the tribe called the long-winged-hawks—their names and descriptions—have attachment to their feeder, and docility the baser race are strangers to—names of hawks of the baser race—those of the generous breed remarkable for courage, swiftness, and docility in obeying the commands and the signs of their master—account of the manner of training a hawk—falconers had a language peculiar, in which they conversed and wrote, iv. 89, &c.

Hawk, (sparrow) pursues the thrush and the linnet, iv. 61—said to be the boldest and best of all others for the chace, 101.

Hawk, (goss) and sparrow-hawk unfit for training—taught to fly at game, but little obtained from them, iv. 101.

Head (of man) externally and internally different from that of all other animals, the monkey kind excepted, i. 423—whence originally the flat heads of the American Indians, ii. 92—of quadrupeds, different from each other, but adapted to their several ways of living, and how, 150—in all birds, except nocturnal, the head smaller, and less proportioned to the body, than in quadrupeds, iv. 7—of the great Greenland whale, makes a third of its bulk, v. 34.

Hearing, extreme delicacy of this sense in birds, iv. 8—that sense in whales, v. 35.

Hearse, name of the female of the stag, the second year, ii. 311.

Heat, Boerhaave considered it so prejudicial to health, that he never went near a fire, i. 269.

Hecla, the bellowings of that volcano believed by the inhabitants of Iceland to be the cries of the damned, i. 76.

Hedge-hog, the most harmless of animals—its description—usual appearance upon the approach of danger—to disgust its enemy from pursuit, sheds its urine, the smell of which is sufficient to send him off—sleeps by day, and ventures out by night—places where found—its food—does not suck cattle—are not hurtful in gardens or orchards—the spines so disposed that no fruit will stick upon them—appears serviceable in ridding the fields of insects and worms—Mr. Buffon accuses it of tricks, of which, from its form and habits, one would not be led to suspect it—he kept males and females together, but they never coupled—time of their coupling—sleep during winter, but do

not lay up provisions for that season—at no time eat much, and remain long without food—blood cold, and their flesh not good for food—their skins converted to no use except to muzzle calves from sucking, iii. 197—destroyed and devoured by the fox—in what manner, 216.

Hedge-hog of the sea, a cartilaginous fish of the sea-orb kind, v. 110.

Hedge-sparrow, a slender-billed bird, iv. 247.

Height, Maximin, the Emperor, above nine feet in stature, i. 436.

Heliogabalus, noted for having the brains of six hundred ostriches dressed in one dish, iv. 45.

Hellebore, the black sort, its pernicious qualities, i. 270.

Hemisphere, half illuminated by northern lights, i. 323.

Hemlock, eat by the horse without injury, ii. 171.

Hemuse, name hunters give the roebuck the third year, ii. 330.

Hen, in the Museum at Brussels, a creature covered with feathers and hair, said to be bred between a rabbit and a hen, iii. 127.

Hen of the common sort, moderately fed, lays above a hundred eggs from spring to autumn, iv. 23—after three years, become effete and barren—clutches one brood of chickens in a season—instances of two very rare—number of eggs of a domestic hen in the year above two hundred, being well fed, supplied with water, and at liberty—trodden by the cock or not, she continues to lay—eggs of this kind never by hatching produce living animals—her nest made without care—clucking season artificially protracted, and entirely removed, in what manner—left to herself would seldom lay above twenty eggs, without attempting to hatch them—as she lays, her eggs being removed, she continues to encrease the number—in the wild state seldom lays above fifteen eggs—particularities of incubation—affection and pride after producing chickens—every invading animal she boldly attacks, the horse, the hog, or the mastiff—marching before her little troop, by a variety of notes, calls her train to their food, or warns them of danger—instance of the brood running for security into a hedge, while the hen stood boldly forth, and faced a fox that came for plunder—artificial method of hatching chickens in stoves, practised at Grand Cairo, or in a laboratory with graduated heat, effected with woollen hens, by Mr. Reaumur—by these contrivances, from a hen naturally producing twelve chickens in the year, are obtained artificially above two hundred, iv. 127—common hen supplies the place of the hen-pheasant, when refusing to hatch her eggs, and performs the task with perseverance and success, 145.

Hen, (Guinea) or *Barbary-hen*, described, iv. 147.

Hen, [water) described—residence and food—nest and habits, iv. 342.

Herculaneum overwhelmed in that eruption of Vesuvius, in which Pliny the naturalist was suffocated—its ruins lately discovered at sixty feet below the surface, and forty below the bottom of the sea, i. 78.

Hermaphrodites, such are all animals of the snail kind, v. 224—the bivalve tribe are so too—they require no assistance from each other towards impregnation, 232.

Hermetical-sealing a glass vessel, the meaning of it, i. 142.

Heron, the great heron, in former times, bred familiarly in our marshes—not now, and why, iv. 24—anatomical distinction in which herons differ from other birds—of this tribe Brisson has enumerated forty-seven sorts—excessively destructive and voracious—ever have lean and carrion bodies—description of the common heron—flies at the approach of the sparrow-hawk—commits the greatest devastations in fresh waters—a fish ever so large he will strike at, though unable to carry it away—one heron, says Willughby, will destroy fifteen thousand carp in half a year—usual attitude, waiting for prey—food in cold and stormy seasons—manner of fishing—Willughby's receipt for taking him—their nests—never in flocks when they fish; but making nests, they love each other's society—flesh of the young esteemed in France—method used to obtain them—the young once excluded, the old incessantly provide them with an amazing quantity of fish—instance of it—by Mr. Keysler's account, this bird may exceed sixty years—recent instance of one taken in Holland, with a silver plate to one leg, and an inscription, that it had been struck by the elector of Cologne's hawks thirty-five years before—they contract a consumptive disposition, 309, &c.

Heron-hawking, a favourite diversion among our ancestors—had laws enacted for the preservation of the species—he who destroyed their eggs was liable to a penalty of twenty shillings for each offence, iv. 310.

Herrera confirms the existence of giants, ii. 109.

Herring, its description, v. 128—of migrating fish, this and the pilchard take the most adventurous voyages—places where the herrings are in greatest abundance—numerous enemies met in their migrations—in Chesapeak Bay, the shoals so great as to cover the shores, and become a nuisance—that body upon our coasts, begins to appear off the Shetland Isles in April; forerunners of the grand shoal descending in June, and announced by the gannet, gull, &c.—fishermen take two thousand barrels at a single draught—places of Europe where herrings are punctual in their visitations—doubts in every part of their migration—first great bank for herrings was along the Norway shore—before 1584, the number of ships from various parts of Europe, resorting thither, exceeded some thousands—quantity of herrings then assembled there, was such, that a spear stuck in the water, as Olaus Magnus assers, would

stand on end—soon after that period they deserted the Norway shores, and took up along the German coasts—no cause assigned for this seemingly capricious desertion—their greatest colonies now in the British channel, and upon the Irish shores—a herring suffered to multiply, unmolested and undiminished, for twenty years, would shew a progeny greater in bulk than ten such globes as that we live upon, 138.

Hexagons, the most convenient figures in building—cells of bees are perfectly hexagons, vi. 96.

Hide of the elk, often known to turn a musket-ball, ii. 339.

Hiera, island in the Mediterranean, formed by subterraneous explosions, i. 105.

Hind, or female of the stag, has no horns—time of gestation, and usual season of bringing forth—hides her young in obscure thickets—obliged to use all arts to conceal them from the stag, the most dangerous of her pursuers—how she defends her young, ii. 306—the female stag so called the third year, 311—manner of knowing the track of a hind, 313—inhabitants of Canada have no other milk but that of the hind; and no other cheese but that made of it, 320—the hunters name for the roe-buck, the first year, 330.

Hippocampus, the *sea-horse*, it description, v. 109.

Hippocrates, his opinion about the formation of the incipient animal, i. 357.

Hippopotamos, not afraid singly to oppose the lion, ii. 402—its dimensions—places where it resides—its food—swims with much force, and remains at the bottom for thirty or forty minutes—it commits dreadful havock among the plantations—method the Africans use to frighten it back to its element—inoffensive in its dispositions—never attacks mariners in their boats, unless inadvertently struck against, or otherwise disturbed, then it would send them at once to the bottom—instances of its great strength—never goes beyond the mouth of fresh-water rivers—attacked on shore, and incapable of vengeance upon a flying enemy, returns to the river, and plunges in head foremost—the negroes apprised of its force, do not engage it—continues uncontrouled master of the river; all others fly its approach, or become an easy prey—moves slowly upon land—seldom goes from the river side, unless pressed by necessities of hunger, or of bringing forth its young—lives upon fish and vegetables—natives of Africa say it often devours children, and other creatures surprised upon land—the young are excellent eating—the female seldom produces above one at a time; hearing the slightest noise she dashes into the stream, and the young one follows her with equal alacrity—Dr. Pococke has seen their flesh sold on the shambles like beef; their breast thought as delicate eating as veal—this creature, once plenty at the mouth of the Nile, now

wholly unknown in Lower Egypt, and no where found but above the cataracts, iii. 362.

Historian, (Natural) his proper business, i. 5—going too much into speculation wrong, and why, 15—method his principal help, ii. 130—faults of systematic writers 132.

History, (Natural) of all other sciences, has the least danger of obscurity, and why, ii. 139—best set forth, as Mr. Locke has observed, by drawings of animals taken from life, 144.

Hobby, bird of the generous breed of hawks, for smaller game, daring larks, and stooping at quails, iv. 92.

Hogs, animals of this kind resemble those of the horse as well as the cow kind, and in what—this kind partakes of the rapacious and the peaceful kinds—offend no animal of the forest—remarkable that none of this kind ever shed their teeth any animal dying in the forest, or so wounded as to make no resistance, is the prey of the hog, who refuses no animal food, however putrid—in a state of wildness, most delicate in the choice of its vegetables; rejects a greater number than any other—they eat but seventy-two plants, and reject one hundred and seventy—indelicacy of this animal more in our apprehensions than in its nature, and why—in orchards of peach-trees, in North America, reject the fruit that has lain a few hours on the ground, and watch hours for a fresh wind-fall—have had mice burrowing in their backs, while fattening in the sty, without seeming to perceive it—scent the hounds at a distance—by nature stupid, inactive, and drowsy; has passions more active only when incited by venery, or when the wind blows with vehemence—foresees the approach of bad weather—much agitated on hearing any of its kind in distress—have often gathered round a dog that teazed them, and killed him upon the spot—their various diseases—generally live, when permitted, to eighteen or twenty years; the females produce to the age of fifteen—in the wild state less prolific, ii. 357, &c.

Hog, (Guinea) and that about Upsal, described, ii. 366.

Hog, (water.) See *Capibara*, ii. 373.

Hog of Borneo. See *Babyrouessa*, ii. 375.

Hog of the isthmus of Darien, described by Wafer, ii. 378.

Holland, a conquest from the sea, and rescued from its bosom—the surface of its earth below the level of the bottom of the sea; upon approaching the coast, it is looked down upon from the sea, as into a valley; is every day rising higher, and by what means—those parts, which formerly admitted large men of war, are now too shallow to receive ships of moderate burthen, i. 230.

Honey, from what part of the flower it is extracted, vi. 100—two kinds of it—which to be preferred, 110—that gathered by the humble bees not so fine nor so good as that of the common bees, 112—gathered by the black bees in the tropi-

cal climates, neither so unpalatable nor so surfeiting as ours—produced by the bees at Guadaloupe, never congeals, remains fluid, of the consistence of oil, with the colour of amber, 111.

Honeycomb, name of the second stomach of ruminating animals, ii. 219.

Honey-guide, a kind of cuckoo, iv. 211.

Honey-weasel, feeds on honey, to which it is conducted by the honey-guide, iii. 116.

Hooded-squirrel, of Java, described by Mr. Pennant, iii. 146.

Hoof of the Persian mares so hard that shoeing is unnecessary, ii. 183.

Hooper, name of the wild swan, on account of the harshness of its voice, iv. 401.

Horizon, seems wrapt in a muddy cloud, upon the approach of winter, under the line, i. 324.

Horn, to wind it, and to carry the hawk fair, formerly sufficient accomplishments for noblemen's sons, iv. 89.

Horned-viper described, v. 371.

Horns, in what manner those of animals are produced, i. 423.—grow differently in deer from those of sheep or cows—deers horns furrowed along the sides, and why—in every respect resembling a vegetable substance, grafted upon the head of the stag—beauty and size of those of a stag, mark their strength and their vigour—the time of shedding them—severe winters retard shedding the horns in stags—generally increase in thickness and height from the second year to the eighth—partake of the nature of the soil—their horns shed, they seek the plainer part of the country, remote from those animals they are then unable to oppose; and walk with their heads stooping down, to prevent striking against the branches of trees ii. 297—of a stag, called his head—their names according t different ages of the stag, 311—the author saw one of ten feet nine inches from one tip to the other, 334—of the elk, applied to the same purposes as hartshorn, 339—of the reindeer, converted into glue, 354—of the rhinoceros, sometimes from three to three feet and a half long, composed of the most solid substance, and pointed to inflict most fatal wounds, iii. 358—of owls, nothing more than two or three feathers, that stand up on each side of the head, over the ear, iv. 108.

Horse, characteristic marks given by Linnæus—eats hemlock without injury, ii. 170—near as the ape approaches man in internal conformation, so the horse is the most remote—wild horses herd together, and feed in droves of five or six hundred—one among their number always stands as centinel, 172—allured by music, 39—not readily attacked by the lion—the combats between them in Italy, 154—one fond of oysters, 160—from what country the horse came originally uncertain—according to the ancients wild horses once in Europe—the colder climates do not agree with them, 174—how wild horses

are caught—set at liberty, they never become wild again—the buccaneers agreeably surprised to see their faithful horses present themselves again with their usual assiduity, and receive the rein, 175—wild horses finding a tame horse to associate with them, gather round him, and oblige him to seek safety by flight—this animal in its state of nature in the old, not the new world—countries where wild horses are found—the natives of Angola, or Cafraria, catch a horse only to eat him. —*Arabian wild horses*, the most beautiful breed, the most generous, swift, and persevering, 176—the negroes shew terror and surprise, when first they see a horse—no Arabian, however poor, but has his horse—tame Arabian horses, some valued at a thousand ducats—different classes among the Arabians—they know the race of a horse by his appearance—Arabians preserve the pedigree of their horses with care, for several ages, 178—countries into which the race of their horses has spread itself, 182—treat their horses gently—hold a discourse with them—written attestations given to persons who buy Arabian horses, 322—they stand stock still in the midst of their career, the rider happening to fall—keep them saddled at their tents, from morning to night, to prevent surprise—when the Arabians begin to break their horses—how the Arabians dress and feed their horses—first began the management of horses in the time of sheque Ismael, ii. 320—the rapidity of the flight of Arabian horses is such, that the dogs give up the pursuit, 180—upon computation, the speed of the English horses is one-fourth greater, carrying a rider, than that of the swiftest barb without one, 183—Numidian race much degenerated—the Tingitanians and Egyptians have the fame of rearing the finest horses for size and beauty—horses of Barbary—an Italian peculiar sport, in which horses of this breed run against each other—Spanish genette described, 184—those of Andalusia pass for the best, and preferred as war horses to those of every other country—Italian horses have a peculiar aptitude to prance—the horses of *India* weak and washy—fed with pease, sugar, and butter—one brought to England not much larger than a common mastiff—climates excessively hot seem unfavourable to horses—remarkable sports on horseback—the horses of the Gold Coast and Guinea extremely little, but very manageable—of *China*, weak, little, ill-shaped, and cowardly—those of *Corea* so timorous, as not to be serviceable in war—*Tartar* horses very serviceable in war; they were properly the conquerors of China—march two or three days without stopping—continue five or six without eating more than a handful of grass at every eight hours; and remain without drinking four-and-twenty hours—lose all their strength when brought into China or the Indies; thrive pretty well in Persia and Turky, 189—ancient opinions on the nature and qualities of the horses of Thessaly, Achaia,

Ethiopia, Arabia, Africa, Italy, and particularly of Apulia, of Sicily, Cappadocia, Syria, Armenia, Media, Persia, of Sardinia and Corsica, of Spain, Wallachia, Transylvania, of Denmark, Scandinavia, Flanders, of the Gaulish horses, of the German, Swiss, Hungarian, and, lastly, of the Indian horses, 191—*Danish* horses of such excellent size, and strong make, that they are preferred to all others for draught, 185—*English* horses excel the Arabian in size and swiftness; are more durable than the barb, and more hardy than the Persian—one instance of their great rapidity, in the admirable Childers, frequently known to move above eighty-two feet and a half in a second, 193—Roger de Belegme, the first recorded to have attempted mending our native breed, 194—number of horses in London, in the time of king Stephen, said to have amounted to twenty thousand—in the times of queen Elizabeth, the kingdom could not supply two thousand horses to form the cavalry—Powisland, in Wales, for many ages famous for a swift and generous race of horses, and why, 195—the horse and the ass differ not so much in form as the cow and the bison, yet the former are distinct animals, and the latter animals of the same kind, 229—eat two hundred and sixty-two plants, and reject two hundred and twelve, 362—are killed by wild asses, ii. 203—destroyed by the American bat, called vampyre, in South America, iii. 235.

Horſe, (Sea) described, v. 109.

Hoſpitals erected in India, for the maintenance of all kinds of vermin, ii. 81—for monkies, iii. 313.

Hottentots, outstrip lions in the chace, as travellers report, i. 433 make much and very extraordinary use of the bison, ii. 234.

Hound, harrier, and *beagle*, all of the same kind—*greymatin*, hound, transported to the North, becomes a great Danish dog; and this, sent into the South, becomes a greyhound of different sizes; and the same, transported into Ireland, the Ukraine, Tartary, Epirus, and Albania, becomes the great wolf-dog, known by the name of the *Irish wolf-dog*—the *blood-hound*, a dog of the generous kind—and likewise the *gaze-hound*, and the *grey-hound*—the blood-hound a dog of great use, and in high esteem among our ancestors—its employ—the gaze-hound hunted, like our grey-hound, by the eye, not by the scent, iii. 12.

Grey-hound-fox, the largest, tallest, and boldest of the kind, iii. 51.

Humber, a new island formed at the mouth of this river—it is about nine miles in circumference, and worth to the proprietor about eight hundred pounds a year, i. 111.

Humming-bird, is the smallest of birds, and seems nearly allied to the insect, iv. 30—belongs to the sparrow kind, 247—the smallest of them about the size of a hazel-nut—its description—the larger humming-bird is near half as big as the com-

mon wren—its description—are seen fluttering about the flowers, without ever lighting upon them—their wings in such rapid motion, it is impossible to discern their colours, except by their glittering—but only extracting their honey as with a kiss—their nests and the number of eggs—their time of incubation—instance of their docility—countries where found—in the Leeward Islands they continue in a torpid state during the severity of winter—Labat asserts, that besides the humming noise produced by their wings, they have a pleasing melancholy melody in their voices, small and proportioned to their organs—the Indians made use of this pretty bird's plumage—in what manner the children take them—when taken, they are instantly killed, and hung up in the chimney to dry; some dry them in stoves—at present the bird is taken rather for selling as a curiosity to Europeans, than an ornament for themselves, 277, &c.

Hump of the bison of different sizes, weighing from forty to fifty pounds, sometimes less—cut and tastes likes a dressed udder, ii. 236—in a few generations it wears away, 237.

Hunger, every animal endures the wants of sleep and hunger with less injury to health than man—hunger kills man sooner than watchfulness—more dreadful in its approaches than continuance—dreadful effects of hunger, related to the author by the captain of a ship, who was one of six that endured it in its extremities—different opinions concerning the cause of hunger—few instances of men dying, except at sea, of absolute hunger—those men whose every day may be considered as an happy escape from famine, at last die of a disorder caused by hunger—the number of such as die in London of hunger supposed not less than two thousand in a year—method of palliating hunger among the American Indians, ii. 1. —instances of amazing patience in hunger, 75.

Hunters, the English considered as the noblest and the most useful horses in the world, ii. 104—terms used by hunters in pursuing the stag—names invented by them for the stag, 311 —for the fallow deer, 323.

Hunting, the natural right of hunting made royal, and when, ii. 308—the stag and the buck performed in the same manner in England, and how, 310—ancient manner of hunting the stag —the manner in Sicily, and in China, 316—the wolf, iii. 39—wolves used in hunting 42—hunting of the fox, 47—hunting the sable chiefly the lot of the exiles in Siberia 93—the ouran-outang, or wild man, in Borneo—a favourite amusement of the king, 285—of the elephant at the Cape of Good Hope, 355—manner of hunting the ostrich, by the Arabians, and by the Struthophagi, iv. 45—manner of hunting the turkey, 138.

Hunting-leopard, described by Mr. Pennant, ii. 426.

Hurricane, the cloud preceding a hurricane, called by sailors, bull's eye, described—houses, made of timber, bend to the

blast of the hurricane like osiers, and recover their rectitude —hurricanes offensive to the sense of smelling—maggots brought with them—common in all tropical climates; on the coasts of Guinea, frequently three or four in a day—their seasons upon those coasts, at Loango and the opposite coast of Africa—the hurricane called tornado, its dreadful effects, i. 297.

Huso, the isinglass fish, caught in great quantities in the Danube, from October to January—furnishes the commodity called isinglass—often above four hundred pounds weight—its flesh salted is better tasted, and turns red like salmon, v. 104.

Hyæna, no words give an idea adequate to this animal's figure, deformity, and fierceness—more savage and untameable than any quadruped—its descripton—defends itself against the lion, is a match for the panther, and attacks the ounce, which it seldom fails to conquer—an obscene and solitary animal—its first howl sometimes mistaken for the voice of a man moaning—its latter like the violent efforts of reathing—whence it first took its name—native of the torrid zone, resides in the caverns of mountains, the clefts of rocks, or dens it has formed under earth—taken ever so young, it never can be tamed—sometimes attacks man, and carries off cattle—its eyes shine by night; and it is asserted that it sees better by night than by day—scrapes up graves, and devours dead bodies, how putrid soever—absurdities of the ancients about this animal, iii. 62, &c.

I.

Jabiru, and *jabira* and *jabira-guacu*, birds of the crane kind, natives of Brasil—their descriptions, iv. 306.

Jackalls, hunt in a pack, and encourage each other by mutual cries—what has given rise to the report of its being the lion's provider, ii. 156—travellers have mistaken the jackall for the fox, iii. 51—one of the commonest wild animals in the East; yet scarce any less known in Europe; or less distinctly described by natural historians—its description—its cry a lamentation resembling that of human distress—is more noisy in its pursuits than the dog, more voracious than the wolf—never goes alone, but always in a pack of forty or fifty together—seems little afraid of man; pursues its game to the doors, without apprehension—enters insolently into sheep-folds, yards, and stables, and finding nothing else, devours leather harnesses, boots, and shoes—scratches up new made graves, and devours the corpse, how putrid soever—the corpse how

dug up—follows armies, and keeps in the rear of caravans—the most putrid substances it greedily devours—hides in holes by day, and appears abroad at night-fall—hunts by the scent—irreconcileable antipathy between it and the dog—no wonder it be voracious, and why—is as stupid as impudent—instance of it—Indian peasants often chace it as we do foxes, 56, &c.

Jack-daw, its description, iv. 178—rings found in the nest of a tame jack-daw, 171.

Jacobines, a kind of pigeons, iv. 231.

Jaculus, the swiftest serpent, its manner of progression by coiling, v. 369.

Jaguar, or the panther of America, ii. 425.

Japanese, description of that people, ii. 78.

Jaw, the upper, thought by many quite immoveable; that it moves in man an easy experiment will evince—has its proper muscles behind the head for thus raising and depressing it—under jaw in the embryo much advanced before the upper; in the adult it hangs more backward—and in a Chinese face it falls still more backward than with us; the difference is thought half an inch, the mouth being shut naturally—a professor at Edinburgh was subject to have his jaw dislocated—the under jaw has often au involuntary quivering motion; and often a state of langour produces another, that of yawning, a very sympathetic kind of languid motion—ridiculous instance of this sympathetic affection commonly practised upon the famous M'Laurin, i. 414.

Jay, one of the most beautiful of the British birds—its description—feeds upon fruits, kills small birds, and is extremely docile, iv. 186—lays its eggs in the holes deserted by the woodpecker, 194.

Ibex, a native of the Alps, the Pyrenees, and the mountains of Greece—its description, ii. 268.

Ibis, the Egyptians paid divine honours to this bird—different opinions concerning the ancient and modern ibis—Maillet's observations to this purpose—the true ibis thought a bird of the vulture kind, called by some the capon of Pharoah, iv. 302—the true ibis found to be the balearic crane, 305—described, 303.

Ice, very elastic, i. 152—floats of it diffused into plains of above two hundred leagues in length—and mountains of it rising amidst them—flat ice, and mountain ice—their formation—mountains of it presenting the resemblance of a glory, 203.

Ichneumon, by some injudiciously denominated the cat of Pharoah, one of the boldest aud most useful animals of the weasel-kind—used in Egypt for the same purposes as cats in Europe—description—discovers and destroys the eggs of the crocodile—serpents its most natural food—grows fast and dies

soon—easily strangles a cat stronger and larger than itself—countries where found—attacks every living thing it is able to overcome, and fears not the force of the dog, nor the claws of the vulture—takes the water like an otter, and will continue under much longer—not able to support the rigour of our winters—one from the island of Ceylon climbed up the walls and the trees with very great ease—this animal one of those formerly worshipped by the Egyptians, iii. 94, &c.

Ichneumon (fly,) its weapon of defence—flies of this tribe owe their birth to the destruction of some other insect, within whose body they have been deposited, and upon whose vitals they have preyed, till they came to maturity—of all others the most formidable to insects of various kinds—it makes the body of the caterpillar the place for depositing its eggs—the tribe is not the caterpillar's offspring, as was supposed, but its murderers—description—whence its name—fears not the wasp, and plunders its habitations—various appetites of the various kinds of this fly—the millions of insects this fly kills in a summer inconceivable, vi. 127.

Ichneumon, a root the Indians believe an antidote for the bite of the asp or the viper, iii. 95.

Jean-le-Blanc, a kind of eagle—its distinctive marks, iv. 73.

Jerboa, a singular quadruped, described, iii. 406.

Jerusalem, the kingdom of, with most of the cities of Syria, destroyed by an earthquake, i. 93.

Jester, in England, as late as the the times of king James I. the court was furnished with a jester, ii. 101.

Ignis-fatuus, or *wandering fire*, i. 325.

Iguana, description of this animal—its flesh the greatest delicacy of Africa and America—its food—in what manner it is taken, v. 317.

Jiboya, the Great, of Brasil, the dimensions of this serpent, v. 378.

Ilex, the berry-bearing ilex. See *Kermes*, vi. 154.

Imagination, by day, as well as by night, always employed, ii. 17—very remarkable instances of its power in women, 96.

Impaling, in some courts of the more barbarous princes of India they employ the elephant to impale the criminals on its enormous tusks, iii. 253.

Impregnation, the hare, though already impregnated, admits the male, and receives a second impregnation, iii. 120—in what manner the sea and garden snails impregnate each other respectively, v. 215—the bivalve-shell-fish require no assistance from each other towards impregnation, 232—frogs impregnated without any apparent instruments of generation, an object of enquiry; continues in great obscurity—experiments made to this purpose, 260.

Incas, father Acosta, and Garcilasso de la Vega, have seen the

bodies of several incas perfectly preserved from corruption, ii. 118.

India, (East) in the warm countries of India, the women are marriageable at nine or ten, and the men at twelve or thirteen, i. 399—description of the islands that lie scattered in the Indian ocean—over all India, children arrive sooner at maturity, than in Europe—they often marry, and consummate, the husband at ten years old, and the wife at eight, and frequently have children at that age,—Indians have long been remarkable for cowardice and effeminacy—they may be considered as a feeble race of sensualists—their dress, ii. 80—the horses of India are weak and washy, 189—lions are found to diminish in their numbers in this country, 393—the Indians eagerly pursue the porcupine, in order to make embroidery of its quills, and to eat its flesh, iii. 209—they eat bats in the East Indies, 231. See *Elephant*.

India, (West) whence originally come the flat heads of the American Indians, ii. 92.

Indus, river, its course, i. 177—its water, and that of the Thames, the most light and wholesome in the world, 143—the tide at the mouth of this river the greatest known, 215.

Infants, just born, may be said to come from one element to another, and why—open their eyes the instant of their birth—more capable of sustaining hunger, and more patient of cold than grown persons, and why—infants have milk in their own breasts—their life very precarious, till the age of three or four—instances of it—the comparative progress of the understanding greater in infants than in children of three or four years old, i. 385.

Insects, in the internal parts of South America, and Africa, they grow to a prodigious size, and why—those of the minute kind in the northern climates not half so large as in the temperate zone—the ocean has its insects—their feet are placed upon their backs, and almost all without eyes—in some countries almost darken the air, and a candle cannot be lighted without their instantly flying upon it, and putting out the flame, i. 349—many may be supplied by being cut in pieces, ii. 363—many of the tribes brought forth from the egg, 365—have no eye-lids whatsoever, 411—the Indians are fearful of killing the meanest, ii. 81—afford so great a variety as to elude the search of the most inquisitive pursuer, iv. 2—those with the greatest number of legs move the slowest, v. 249—the general definition of insects—the different classes—general characteristics of insects without wings, v. 385—of those that have wings, vi. 1—some continue under the form of an aurelia not ten days; some twenty, some several months, and even for a year, 62—general rule, that the female is larger than the male, 73—every insect that lives a year after its full growth, is obliged to pass four or five months without nourish-

ment, and will seem to be dead all that time, 137—description of that which forms and resides in the gall-nut, 157.

Instinct of animals in chusing the proper times of copulation, ii. 168—the Guinea-pig has not that natural instinct so common to almost every other creature, iii. 162.

Intestines, in all animals the size of the intestines proportioned to the nature of the food, ii. 152—intestines of ruminating animals enlarged by nature, to take in a greater supply—those of the carnivorous kind are short—also thin and lean, but of the ruminating are strong, fleshy, and covered with fat, 218—of sheep found to be thirty times the length of the body—those of the wild cat not above three times the length of its body, 389—of the rein-deer, washed like our tripe, in high esteem among the Laplanders, 354—of the bat, in some measure resemble those of man, iii. 226—those of the manati longer, in proportion, than those of any other creature, the horse excepted, 270—the tribe of wood-peckers want that intestine called the cæcum, iv. 191—the lamprey seems to have but one, v. 96—those of the crab have many convolutions, 171.

Inundations generally greater towards the sourse of rivers than farther down; and why, i. 173—some distribute health and plenty—others cause diseases, famine, and death, 183—every inundation of the sea attended with some correspondent dereliction of another shore—one of the most considerable in history, is that which happened in the reign of Henry I.—an inundation in the territory of Dort destroyed an hundred thousand persons—and yet a greater number rund the Dullart—remarkable inundations in Friezland and Zealand, in which more than three hundred villages were overwhelmed—their remains continue visible at the bottom of the water in a clear day—some in which the sea has overflowed the country, and afterwards retired, 231—inundation of the Thames at Dagenham, in Essex, 236—instantly produced by land spouts, 338.

Johndory, Quin noted for a sauce for this fish, v. 25.

Ireland not infested with wolves, iii. 40—frogs designedly introduced into that kingdom some years before the Norway rat—that rat put a stop to their increase, and the frog is once more almost extinct in that kingdom, 169—the mole utterly a stranger there, 190.

Iron extracted from all the substances upon earth, i. 64.

Isatis, an animal very common in all northern countries bordering upon the icy sea, and seldom found in warm climates—description—burrows like the fox, and, when with young, the female retires to her kennel, in the same manner as the fox—its kennel very narrow, and extremely deep, has many outlets—manner of coupling, time of gestation, and number

of young, all similar to what is found in the fox—brings forth at the end of May, or the beginning of June—considered as between the dog and the fox—changes its colour, and is at one time brown, at another white—time in which it is called the *crost-fox*, iii. 61, &c.

Isinglass, serviceable in medicine, and many arts,—manner of making it—principally furnished from Russia, where great quantities are prepared surprisingly cheap—Mr. Jackson found out a method of making a glue that answered the purposes of isinglass, v. 99, 104.

Islands, new-formed, in two ways—thirteen islands in the Mediterranean appearing at once emerging from the water—one new-formed in the year 1720 near that of Tercera—formed at the mouths of many rivers, and how, a beautiful and large one formed at the mouth of the river Nanquin in China, not less than sixty miles long, and about twenty broad, i. 105—appear, at first, infinitely greater than they naturally are, 332—seem to travel to the shore, and represent curious figures, ships with sails, streamers, flags, and antique elevated castles, and at length vanish into nothing, 333.

Juda-goat common in Guinea, Angola, and all along the coasts of Africa, not much larger than a hare, ii. 266.

Jugular fish, name given to that fish which has the ventral fins placed more forward than the pectoral, v. 120.

Juniper, its shade said to be fatal, by the ancients, i. 270—the Laplanders drink water, in which these berries have been infused, ii. 74.

Ivory, the tusks of the babyrouessa are a very fine ivory, smoother and whiter than that of the elephant, but not so hard or serviceable, ii. 377—that of the morse more esteemed than that of the elephant, being whiter and harder, iii. 267—almost all our ivory comes from Africa, where the greatest part is found in the forests—the tusks of the mammouth converted to the purposes of ivory, 355—teeth of the narwhal far surpass ivory in all its qualities, v. 47.

Ivy-berries, shower of them raised by tempests in one country, and falling in another, i. 333.

K.

Kabossu, or Cataphractus, one of the largest kinds of the armadilla, iii. 125.

Kamskatka, description of its natives, ii. 72.

Kanguroo, a singular quadruped of New Holland, described, iii. 330.

Keratophites, among the coraline fungi, vi. 197.

Kermes, an insect of great use in medicine and dying—its description—the differences of the male from the female—the harvest of the kermes greater or less in proportion to the severity of the winter—women gather them before sun-rising, tearing them off with their nails, vi. 154.

Kestril, a bird of the generous breed of hawks, iv. 92.

Kevel, name of a second variety of gazelles, made by M. Buffon, ii. 279.

Killer, a cetaceous animal of surprising strength, which attacks the whale, v. 41.

Kinds of animals not actually distinguished by horns, colour, position of the ears, or fineness of hair, ii. 267—difficult to fix precise boundaries between the goat-kind, and the deer, 375—the gazelles form a distinct kind, 376.

Kine, in Iceland are without horns, ii. 232.

King-fisher, a remarkable bird—its description—places it frequents, and how it takes its prey—the plumage a beautiful variety of brilliant colours—instances of credulity with respect to this bird—its nest, or rather hole, very different from that described by the antients—feeds upon fish in that hole—fœtid from the remains of fish—the King-fisher is found with from five to nine eggs, which the female continues to hatch—though disturbed and robbed, she returns and lays again—Reaumur's account of this—season for excluding the brood—the male, faithful beyond the turtle, brings the female large provisions of fish, and keeps her plump and fat—he used to twitter before, now enters the nest quietly and privately—the young hatched in twenty days—differ in their size and beauty, iv. 421.

Kircher has set the voices of some birds to music, iv. 111.

Kite, from the greatest height darts down on its prey with unerring aim, iv. 8—one of the baser race of hawks, 91—distinguished by its forky tail, and slow floating motion—seems ever upon the wing, and to make no effort in flying—lives upon accidental carnage, every bird in the air being able to make its retreat from it—small birds wounded, or straying chickens, it seizes with rapacity, 98—used for training falcons, and how lured with the great horned owl, when caught for that purpose, 113.

Klein, his method of classing animals, ii. 136.

Knobber, name of the stag the second year, ii. 311.

Knot, small bird of the crane kind, iv. 332—a bird of passage, 336.

Kob, the name of the sixth variety of gazelles by Mr. Buffon, ii. 280.

Koba, the name of the fifth variety of gazelles by Mr. Buffon, ii. 280.

Kraken, all that has been said of this great fish seems fictitious, yet there is a possibility of its existence, v. 33.

L.

Labrus, (the wrasse,) description of this fish, v. 123.
Labyrinth, of Candia, a subterranean wonder, supposed the work of art, i. 55.
Labyrinth, convolutions in the wind-pipe and lungs of some birds, iv. 10.
Lama, the camel of the new world,—countries where found—their flesh an excellent food—their hair, or rather wool, spun into beautiful cloathing—carry their burdens over precipices and craggy rocks, where men can scarcely accompany them—description and age—manner of coupling—its food—exceeds the camel in temperance—requires little water, being supplied with quantities of saliva, the only offensive weapon it has to testify its resentment—the Indians say, where this saliva falls, it will, from its acrimonious nature, burn the skin, or cause dangerous eruptions—colour and wool—habits and marks of agility in the state of nature—seems the largest of the camel kind in America—the natives hunt the wild lama for its fleece—a smaller, weaker sort of the camel-kind, called also guanacoe and paco—the manufacture of stuffs, carpets, and quilts, made of the wool of the paco, forms a considerable branch of commerce in South America, and might usefully be extended to Europe, iii. 379, &c.
Lambs, how to be produced all the year round, ii. 169—the third an ewe brings forth supposed to be the best, 255.
Lamprey, a fish every way resembling the lamprey, was possessed of the numbing quality of the torpedo—people will not venture to touch those of Ireland—a species very different from ours served up as a delicacy among the modern Romans—doubtful whether it be the murena of the ancients, which our lamprey is not—ours differently estimated, according to the season—those of the river Severn the most delicate of all fish—description of the fish—extraordinary power of adhering to stones—instance of it—Muralto, in giving the anatomy of this fish, makes no mention of the lungs, for which it has absolute necessity to breathe in the air—its time of leaving the sea annually, in order to spawn, is the beginning of spring—after a few months, it returns to the sea—peculiar preparation for spawning—the young from eggs—the female remains at the place where produced—they are excluded till they come forth—has her family playing about her, and conducts them in triumph to the ocean—its food—some continue in fresh water till they die—a single brood the extent of the

females fertility, two years being the limit of her existence—best season for them the months of March, April, and May—are usually taken in nets with salmon; sometimes in baskets at the bottom of the river—old custom for the city of Gloucester annually to present the King with a lamprey-pie—a senator of Rome used to throw into his ponds such of his slaves as displeased him, to feed the lampreys, v. 93.

Lands, new, produced from the sea, and in what manner, i. 231.

Lanner, bird of the generous breed of hawks, now little known in Europe, iv. 92.

Lanthorn-fly, emits a strong phosphorescent light in the dark, vi. 13.

Lap-dog, described, iii. 16.

Laplanders, one of the first distinct race of men round the polar regions—descriptions of their persons and manners—have in every family a drum for consulting the devil—Gustavus Adolphus attempted in vain to form a regiment of Laplanders—use skaits to run and slide, and how—are all hunters—offer their wives and daughters to strangers, ii. 72.

Lapwing, a small bird of the crane kind, iv. 332—its arts to lead off men and dogs from their nests, 339.

Lark, bird of the sparrow kind, iv. 246—the sky, the wood, or the tit-lark, distinguishable from other little birds, by length of heel and loud song—nest, number of eggs, and habits, 261 those that remain with us the year throughout, are birds of passage in Sweden, 250.

Lark, (sea) a small bird of the crane kind, iv. 332—breeds in this country, 336.

Lava, matter discharged by the eruptions of volcanoes, i. 87.

Laughter, in what manner produced, i. 416.

Launce, description of this fish, v. 127.

Layer, the impression on the place where the stag has lain, ii. 312.

Layers of the earth regularly disposed, but not of the same kind in every place—enumeration of layers of earth in a well dug at Amsterdam, and of another dug at Marley—a layer, as far as it extends, always maintains the same thickness—proceeding to considerable depths, every layer is thicker—are sometimes very extensive, and often found to spread over a space of some leagues in circumference, i. 47—remarkable layers of earth round the city of Modena, 234.

Leather, called shammoy, made of the skin of that animal, and also from those of the tame goat, the sheep, and the deer, ii. 271.

Leaves, two of a fig-tree, by experiment, imbibed from the earth two ounces of water in five hours and a half, i. 164.

Leech, different kinds—its description—takes a large quantity of food—has no anus or passage to eject it from the body when

digested—in what it differs from the rest of the reptile tribe—the leech used in medicine—a girl of nine years old killed by leeches—best way of applying leeches, v. 439.

Legs, a man without legs or hands performed astonishing feats of dexterity, iii. 329.

Leming, a bold animal of the rat kind, native of Scandinavia—often pours downs in myriads from the northern mountains, and, like pestilence, destroys all the productions of the earth—Laplanders believe they drop from the clouds—their description—they move in a square, forward by night, and lying still by day—whither their motions are turned nothing can stop them; a fire, a deep well, a torrent, does not turn them out of their direction—they never retreat—interrupted by a boat across a river, they go over it—stopped by a stack of hay or corn, they gnaw their way through; and obstructed by a house they cannot get through, continue before it till they die—eat nothing prepared for human subsistence—never enter a house to destroy provisions—passing through a meadow, destroy it in a short time, and leave it with the appearance of being burnt up, and strewed over with ashes—a man imprudently attacking one of them, the animal furiously flies at him, barking somewhat like a puppy, fastens, and does not easily quit its hold—their leader forced out of the line, after a long defence, and separated from the rest, sets up a plaintive cry, not of anger, and hangs itself on the fork of a tree—they destroy and devour each other—after incredible devastations, they separate into armies, opposed with deadly hatred, and move along the coasts of the larger lakes and rivers—the Laplanders form prognostics from the manner of their arrangement—what prognostics—the divisions continue their engagements and animosity until one party be overcome; then they disappear, and, it is supposed, that, having nothing to subsist on, they devour each other—their carcases sometimes infect the air for miles around, and produce malignant disorders—they seem also to infect the plants, the cattle often dying in the places where they passed—the male larger and more beautifully spotted than the female—are extremely prolific—breeding does not hinder their march, some carrying one young in their mouth, and another on their back—are greatly preyed upon by the ermine, and even by the rein-deer—dogs and cats detest their flesh, but the Laplanders esteem it good eating, and devour it greedily, iii. 185.

Leopard, the American is neither so fierce nor so valiant as that of Africa and Asia, ii. 163—the large, and the leopard or panther of Senegal,—differences between those animals, 424—leopard will not fly at the approach of the lion, 402.

Lepadogaster, description of this fish, v. 127.

Leprosy, in what manner the Indians endeavour to prevent the

Arabian leprosy, or the elephantiasis, a disease to which man and the elephant are equally subject, iii. 343.
Leuwenhoeck, his opinion about the rudiments of animals, i. 358.
Leymmer, a dog of the generous kind, iii. 13, 15.
Libella, the dragon-fly—general characteristics—eggs—food of the young—how they prepare to change from the reptile to the flying state—description—the strongest and most courageous of all winged insects—the business of impregnation, how performed, vi. 2.
Liboya, the greatest of the serpent kind, v. 336.
Lichen-rangiferinus, the food of the rein-deer, a moss in Lapland of two kinds; the white in the fields, and the black on the trees, ii. 344, 348.
Lidme, name of the eleventh variety of gazelles, by Mr. Buffon, ii. 284.
Life, formerly supposed producible only by oviparous and viviparous generation; but latter discoveries induce many to doubt whether animal life may not be produced merely from putrefaction, i. 362—the beginning of our lives, as well as the end, is marked with anguish, 382—that of infants very precarious, till the age of three or four—instances of it, 391—the duration of life in general nearly the same in most countries, ii. 64—the most useless and contemptible of all others, the most difficult to destroy, vi. 178.
Light, the hand exposed to broad day-light for some time, then immediately snatched into a dark room, will still be luminous, and remain so for some time, and why—dangerous to the sight to look steadily upon bright and luminous objects, and why—such persons as read or write for any continuance, should choose a moderate light, ii. 30.
Light sent forth by the glow-worm, how produced hitherto inexplicable, vi. 152—sent forth by the star fish, resembles that of phosphorus, 180.
Lightning is an electrical flash produced by the opposition of two clouds, i. 319—flashing without noise, illuminates the sky all around in the torrid zone, 323—of the torrid zone, is not so fatal or so dangerous as with us, otherwise those regions would be uninhabitable, 325.
Lights, northern lights illuminate half the hemisphere, i. 323.
Limbs of the inhabitants near the Poles are sometimes frozen and drop off, i. 331—some animals live without, and often are seen to reproduce them, vi. 176.
Lime, manner of making it in Persia, i. 74.
Line, upon the approach of the winter months under the Line, the whole horizon seems wrapt in a muddy cloud, i. 324—in America, all that part of the continent which lies under the Line is cool and pleasant, ii. 88—in general, as we approach

the Line, we find the inhabitants of each country grow browner, until the colour deepens into perfect blackness, 89.

Linnæus, the celebrated naturalist, supposes man a native of the tropical climates, and only a sojourner more to the north—argument to prove the contrary, ii. 93—his method of classing animals, 137—makes the female of the bat a *primas*, to rank it in the same order with man, iii. 229.

Linnet, a bird of the sparrow kind, iv. 247—taught to whistle a long and regular tune, 269.

Lion, to compare the strength of the lion with that of man, it should be considered that the claws of this animal give a false idea of its power, ascribing to its force what is the effect of its arms, i. 431—leaps twenty feet at a spring, ii. 156—does not willingly attack the horse, and only when compelled by the keenest hunger—combats between a lion and a horse in Italy—the lion stunned, and left sprawling, the horse escapes; but the lion succeeding, sticks to his prey, and tears the horse in pieces instantly, 154—produced under the burning sun of Africa, is the most terrible and most undaunted creature, 393—description of this noble animal, 397—he degenerates when removed from the torrid zone, 392—a single lion of the desert often attacks an entire caravan, 395—he crouches on his belly, and continues so with patient expectation, until his prey comes within a proper distance, 400—the female has no mane, 399—his roaring is so loud, that when heard in the night, and re-echoed by the mountains, it resembles distant thunder, 401—attends to the call of the jackall, iii. 58—in countries tolerably inhabited, the lion is cowardly, and often scared by the cries of women and children, ii. 382.

Lions, those of Mount Atlas have not the strength or ferocity of those of Bildulgerid or Zaara—species of this animal diminishing daily—Mr. Shaw observes, the Romans carried fifty times as many lions from Lybia in one year, for their amphitheatres, as are in the whole country at this time—the same remark made with regard to Turkey, Persia, and the Indies; where the lions diminish in their number daily—those inhabiting the peopled countries of Morocco or India, scared away with a shout—the keepers play with him, plague, and chastise him without a cause, he bears it with composure; but his anger once excited, the consequences are terrible—an instance from Labat—numberless accounts assure his anger noble, his courage magnanimous, and his natural ferocity seldom exerted against his benefactors—he has spared the lives of those thrown to be devoured by him, afforded them part of his subsistence, and sometimes abstains from food himself to support them—necessity alone makes him cruel—the manner of hunting them by Hottentots and others—reported that he sustains hunger a long time, but thirst he cannot support—some be-

lieve him in a continual fever—he drinks as often as he finds water, and laps it—he requires about fifteen pounds of raw flesh in a day—he rather hunts for a fresh spoil, than returns to that he had before—his breath is offensive, and his urine insupportable—horses for hunting them of that sort called charossi; all others fly at the sight of him, ii. 393—the lion prefers the flesh of camels to other food—is also fond of that of young elephants—when old, finding men and quadrupeds together, he attacks the latter, and never meddles with men, unless provoked—manner of copulation, time of gestation, number brought forth, and time taken to come to perfection, all known—a lion in the Tower of London above seventy years—the lioness fearing her retreat discovered, hides her tracks, by running back, or brushing them out with her tail—becomes terrible with young ones to provide for—lions, incited by desire, fight bloody battles, till one becomes victorious over the rest—the size of the lion between three and four feet; the female in all dimensions about one third less—there are properly no lions in America; the *puma* has received the name of the *American lion*, but, when compared, is a very contemptible animal, 404.

Lion-ant, described, vi. 7.

Lion-cat, or *Angora-cat*, a beautiful animal, a native of Syria or Persia, ii. 390.

Lion-dog described, iii. 18.

Lion, (sea) described in Anson's voyages, regarded as the largest of the seal family, iii. 265.

Lipidopus, the garter-fish, its description, v. 128.

Lips, those of the hare and the squirrel continually move, whether sleeping or waking, iii. 118.

Lithophytes and coralline substances, vi. 193.

Litters, in all animals, intermediate litters most fruitful; first and last generally produce fewest and weakest of the kind, ii. 167.

Liver of a shark affords three or four quarts of oil, v. 75.

Lizards, along the coasts of Guinea their flesh esteemed a delicacy, iii. 23--differ from every other class of animals, and from each other—whence the greatest distinction—general characteristics, v. 288—the water kind changes its skin every fourth or fifth day—sprinkled with salt, the whole body emits a viscous liquor, and the lizard dies in three minutes, in great agonies—the whole of the kind sustain the want of food in a surprising manner, 314, 315.

Lizard, *(Chalcidian)* of Aldrovandus, described, v. 323.

Lizard, (Flying) of Java, account of it by Gentil, v. 323.

Loach, the description of this fish, v. 129.

Lobster, very voracious, though without warmth in its body, or red blood in its veins—whatever it seizes upon, and has life, perishes, however well defended—they devour each other,

and, in some measure, eat themselves; changing their shell and stomach every year, the old stomach is the first morsel to glut the new—at first sight, the head may be mistaken for the tail—its description—the food of the young—the molting season—how they change their shells—many die under this operation—speedy growth of the new shell; and of itself after the change—the claws of unequal magnitude, and why—at certain seasons they never meet without an engagement—wonders this extraordinary creature offers to imagination—are endowed with a vital principle, that furnishes out such limbs as have been cut away—varieties of this animal with differences in the claws, little in the habits or conformation—the shell black when taken, but turns red by boiling—common way of taking the lobster, v. 163.

Locust, the great brown *locust* seen in several parts of England in 1748; in some southern kingdoms they are still formidable—description of this insect—in what manner they take the field—their devastations—are still more noxious when dead—instance of it—account of their devastations in Russia, Poland, Lithuania, and Barbary—transformations—eaten by the natives in many kingdoms of the East; and caught in small nets for that purpose—their taste—are considered as a great delicacy in Tonquin, by the rich and the poor—must have been a common food with the Jews—description of the great *West Indian Locust*, the most formidable, vi. 20.

Loir, the greater dormouse, so called by Mr. Buffon, iii. 177.

Longevity, persons remarkable for it, ii. 63.

Lori, the longest of all animals, in proportion to its size—description—a native of the island of Ceylon, iii. 319.

Loricaria, description of this fish, v. 128.

Lories, a kind of parrot, iv. 215.

Louse, its description—whether distinguished by the parts of generation into males and females, not yet discovered—the lousy disease frequent among the ancients, v. 413.

Louse, (Wood) the description—of great use in medicine, v. 426.

Luminous appearance of the waves in the night, the cause, i. 207.

Lump-fish, its description—flung into a pail of water, will stick so close to the bottom, that on taking the fish by the tail, the pail and several gallons of water may be lifted—their flesh, v. 107.

Lungs, animals before birth make no use of their lungs, iii. 258. caterpillars have eighteen lungs, and live several days in the exhausted receiver of the air-pump, vi. 53.

Lybia, its inhabitants use ostriches as horses—also at Joar—instance of it at the factory of Podore, iv. 47.

Lyboija, a serpent of Surinam, thirty-six feet long, v. 336.

Lynx, distinguished from the ounce, and described—first striking distinction between it and those of the panther-kind is the tail—each hair of this animal is of three different colours—

about the size of the ounce—chiefly met with in cold northern countries—those of the new continent are smaller than in Europe—formerly called *lupus cervarius*, but for what reason hard to guess—in its nature it exactly resembles the cat, is bigger, and near two feet long, is also bolder and fiercer—is more delicate than the cat—resembles the wolf in nothing, except its cry—several reports of the lynx, propagated by ignorance or imposture, ii. 429.

M.

Macaguo, a kind of monkey described by Mr. Buffon, iii. 312.

Maccaw, the large kind of parrot, the size of a Raven, iv. 215.

Machinel-tree, its shade fatal, i. 270—no plant will grow under it, 348.

Machines, the invention of many has rendered human strength less valuable, i. 437.

Mackarel, produces five hundred thousand eggs in one season, v. 21—described, 123.

Madness produced by want of sleep, ii. 11—cured by music, and also caused by it, 38.

Maelstroom, Dutch name for a whirlpool, one upon the coast of Norway, considered as most dreadful and destructive—the body of water forming this whirlpool, extended in a circle of above thirteen miles, i. 223.

Magellan, (Ferdinand) a Portuguese of noble extraction, first discovered the gigantic race of mankind, in 1520, towards the extremity of South America—account of this discovery—he was slain upon one of the Molucca islands, ii. 107.

Magot of Buffon, the *Cynocephalus*, the last of the ape kind—its description, iii. 292.

Magpie thievish; rings found in the nest of a tame magpie, iv. 171—habits and food—when satisfied for the present, it lays up the remainder for another time—places where it builds, and nests, described—number of eggs—in its domestic state, preserves its natural character strictly—foolish custom of cutting its tongue to teach it to speak, puts the animal to pain, and baulks the intention, 183.

Maimon, the last of the baboons, Edwards calls it the *pigtail*—its description—native of Sumatra, does not well endure the rigours of our climate, iii. 299.

Maire, (James Le) a traveller who confirms the existence of giants in America, ii. 109.

Maki, their description—many different kinds of these animals, iii. 317, &c.

Malacopterigii, the barbarous Greek name given to the soft-finned fish; the prickly-finned sort termed *Acanthopterigii*, v. 120.

Malbrouk, a monkey of the ancient continent—its description—

the Bramins have hospitals for such as are sick, or disabled, iii. 313.

Malebranche, grounds his beautiful theory of monstrous productions upon a famous instance related by him; and some theory from which he deduces the effects of imagination upon the fœtus, ii. 96.

Mallard, a kind of duck, iv. 411.

Malpighi, his famous experiment upon the stigmata of caterpillars, vi. 53.

Mammouth, its tusks, which are used as ivory, and supposed to belong to the elephant, often weigh four hundred pounds, iii. 356.

Man, endures a greater variety of climates than the lower orders of animals are able to do, and why, i. 264—differences in his species less than in animals and rather taken from the tincture of the skin than variety of figure—there are not in the world above six distinct varieties in the race of men—first race in the polar regions, deep brown, short, oddly shaped, savage—second, the Tartar race, olive coloured, middle sized, ugly, robust—third, the southern Asiatics, dark olive, slender shaped, strait black hair, feeble—fourth, the negroes of Africa, black, smooth skin, woolly hair, well shaped—fifth, the Americans, copper colour, strait black hair, small eyes, slight limbed, not strong—sixth, the Europeans and bordering nations, white of different tints, fine hair, large limbed, vigorous, ii, 71—may be called the animal of every climate, i. 352—white men resemble our common parent more than the rest of his children—a native of the tropical climates, and only a sojourner more to the north, according to Linnæus—arguments sufficient to prove the contrary, ii. 92—as man has a superiority of powers over other animals, so is he proportionably inferior to them in his necessities—nature has made him subject to more wants and infirmities than other creatures: but all these wants seem given to multiply the number of his enjoyments—and in what manner, 2—first sensations of a man newly brought into existence, and the steps by which he arrives at reality pointed out by Mr. Buffon, 52—the only animal that supports himself perfectly erect—man's feet also different from those of other animals, the apes not excepted—the nails less in man than in any animal—said to be tall when from five feet eight inches to six feet high, i. 426—probability that men have been, in all ages, much of the same size they are at present—many corroborating proofs of this, ii. 112—generally live to ninety or a hundred years, if not cut off by diseases—how men lived so much longer in earlier times than at present, 64—proportionably stronger for his size than any other animal—to compare the strength of a lion with that of man, it must be considered the claws of the animal give a false idea of its power; and ascribe to its force the

effects of its arms—another manner of comparing the strength of man with that of animals, is by the weights which either can carry—Dr. Desaguliers speaks of a man able to raise two thousand pounds, by distributing the weights in such manner that every part of his body bore its share, i. 431—exercised in running, outstrips horses; a stout walker, in a journey, walks down a horse—those employed as messengers at Ispahan, in Persia, runners by profession, go thirty-six leagues in fourteen hours, 433—every animal endures the wants of sleep and hunger with less injury to health than man—he cannot, uninjured, live four days without eating, drinking, and sleeping, ii. 2—one said to live without food for seven days—requires sleep for double motives, the refreshment of the mental as well as the bodily frame, 9—a young man deaf and dumb from his birth, knew nothing of death, and never thought of it till the age of twenty-four, when he began to speak all of a sudden, 44—in those countries where men are most barbarous and stupid, there brutes are most active and sagacious, iii. 311—one without hands or legs, by practice, used his stumps for the most convenient purposes, and performed astonishing feats of dexterity, 329—man dies under wounds which a quadruped or a bird could easily survive, vi. 176.

Manati, may indiscriminately be the last of beasts, or the first of fishes—its description—the female has breasts placed forward, like those of women—the tongue so short, some have pretended it has none—never entirely leaves the water, only advances the head out of the stream, to reach the grass on the river sides—it feeds entirely on vegetables—places where found—graze among turtles and other crustaceous fishes, giving or fearing no disturbance—unmolested, they keep together in large companies, and surround their young—bring forth in autumn; and supposed to go with young eighteen months—the manati has no voice nor cry—its intestines are longer in proportion than those of any other creature, the horse excepted—the fat which lies under the skin, exposed to the sun, has a fine smell and taste, and exceeds the fat of any sea animal—the heat of the sun does not make it rancid; it tastes like the oil of sweet almonds, and serves every way instead of butter; any quantity may be taken inwardly, having no other effect than to keep the body open—the fat of the tail, boiled, more delicate than the former—the lean takes a long time in boiling, and eats like beef—the fat of the young like pork, and the lean like veal, iii. 266, 267.

Mandril, the largest of the baboon kind—its description—when displeased weeps like a child—is a native of the Gold Coast, iii. 298,

Mangabey, a monkey of the ancient continent—its description, iii, 313.

Manis, or Pangolin, described, iii. 213.

Manufactures, the woollen manufacture not carried on here till several ages after sheep were propagated in England—unavailing efforts of our Kings to introduce and preserve it—the Flemings possessed the art in a superior degree—the inhabitants of the Netherlands improved us in this art, and when—the woollen manufacture supposed for some time decaying amongst us—received every encouragement from Queen Elizabeth, ii. 253——of stuffs of the wool of the pacos, a considerable branch of commerce in South America, iii. 382.

Marcasites, their composition—experiment by way of proof, i. 66.

Mares, their exportation prohibited by a law in Arabia, ii. 181—studs in Persia of ten thousand white mares, with hoofs so hard that shoeing is unnecessary, 183—a law in England, prohibiting the exportation of mares and stallions; and one similar to this obtained so early as the times of Athelstan, 194.

Marikina, a monkey of the sagoin kind, with a mane round the neck, and a bunch of hare at the end of the tail, like a lion, iii. 316.

Marmose, only differs in size from the oppossum, being less; instead of the bag to receive the young, has only two longitudinal folds, within which the premature young continue to suck—when first produced not above the size of a bean; but stick to the teat until they arrive at maturity, iii. 327.

Marmout, or *Marmotte*, a native of the Alps—its description—is easily tamed, readily taught to dance, wield a stick, and obey the voice of its master—it has an antipathy to the dog,—strength and agility—ludicrous saying that the Savoyards, the only chimney-sweepers of Paris, have learned their art from the marmotte they carry about for shew—is apt to gnaw the furniture—other affections of this animal—its food—is cleanly, but has a disagreeable scent—sleeps during winter—form of its hole resembles the letter Y—manner of making it—they live together, and work in common to make their habitations snug and convenient—when they venture abroad, one is placed as a centinel upon a lofty rock—Mr. Buffon says it does not sleep during winter, is rather in a torpor, a stagnation of all faculties—its heat not more than ten degrees above congelation—the flesh said to have a wild taste, and to cause vomiting—countries where it is found—inhabitants of the Alps do not till winter open its hole—produces but once a year, and brings forth three or four at a time—they grow fast, and their lives are not above nine or ten years, iii. 146.

Marrow, (spinal,) and the brain, the first seen as begun in the embryo, ii. 20.

Martin, its description, the most beautiful of all British beasts of

prey—its scent a pleasing perfume—the yellow-breasted martin—its fur more valuable than the white-breasted sort—Mr. Buffon supposes them a distinct species, that distinction unnecessary—of all the weasel-kind the most pleasing, iii. 87—resembles the ermine and polecat, and like them is fond of honey, 79—seldom meets the wild cat without a combat—wild-cat not a match for the martin—kept tame by Gesner and Mr. Buffon—often slept for two days, and then was two or three days without sleeping—the yellow-breasted more common in France than England—in their retreat the female brings forth her young, three or four at a time—and they come with the eyes closed—how she compensates for her deficiency of milk—this animal more common in North America than in Europe—found in all northern parts of the world, from Siberia to China and Canada—in every country hunted for their furs, very valuable, and chiefly so when taken in the beginning of winter—one part of its skin most esteemed—twelve thousand of these skins annually imported into England from Hudson's-bay, and thirty thousand from Canada—small birds alarm the spot where the dam keeps her young, and direct the hunter in his pursuit, 88, &c.—its nest generally the tenement of the squirrel, taking possession, and killing the owner—the white-breasted keeps near houses and villages; the yellow keeps in woods, leads a savage life, 141, seizes also the flying-squirrel, 146.

Martin, a bird of the swallow-tribe, iv. 270.

Marum, cats excessively fond of this plant, ii. 386.

Mastiff, one of the three descendants of the shepherd's dog—chiefly a native of England; when transported into Denmark becomes the little Danish dog, iii. 11—the Dutch mastiff, 14.

Mastiff-fox, second variety of foxes, less than the greyhound-fox, and stronger than the cur-fox, iii. 51.

Maturity, attained to by slow steps, announces a slow march to old age—as true in other animals as in man and vegetables, ii. 62—sooner arrived at in India than in Europe, 81.

Maw, in fishes, possesses the power of digesting, v. 11.

Maximin, (the Emperor) a prodigy of strength—several instances of it—by birth a Thracian; from being a simple herdsman he rose by the gradations of office, until he came to be Emperor of Rome, was above nine feet in height, and the best proportioned man in the empire—was killed by his own soldiers, while sleeping, i. 436.

May-bug, or *Dorr-beetle*, described, vi. 144. See *Beetle*.

Mechanism, which regulates the number of our years, admits no change in its laws, and can be affected only by long fasting, or great excess, ii. 64.

Medauro, the brass helmet dug up there fits a common man, yet

is allowed to have been left there at the overthrow of Asdubal, ii. 112.

Mediterranean-sea, always receiving, and never discharging water, is no way fuller than before—in what manner some account for this, i. 219—water-spouts seen in it—description of them by Tournefort, 334—solutions offered for this phenomenon by Mr. Buffon and Dr. Stewart, 336—this sea one of the smoothest and most gentle in the world, 222.

Medusa, name given by Linnæus to a small insect, thought the simple food of the great Greenland whale—walfischoas, the name given to it by the Icelanders, v. 39, 112.

Membrane, the nictitating membrane in birds—veils the eye at pleasure, whilst the eye-lid continues open, iv. 7.

Menstruum, that body which is most fluid and penetrating, is likely to be the menstruum of one less so—Marriotte's experiment shews that water will act as a menstruum upon air—cold diminishes the force of menstruums, and often promotes evaporation, i. 314.

Merlin, the smallest of the hawk or falcon-kind, scarce larger than a thrush, displays a degree of courage rendering him formidable to birds far above his size—kills a partridge or a quail at a single pounce from above, iv. 92.

Metals, the richest, in their native state, less glittering and splendid than useless marcasites, i. 64—those trades that deal in their preparations, always unwholesome, 269—all pieces swallowed by animals lose part of their weight, and often the extremities of their figure, iv. 41.

Meteors, between the tropics, and near the poles, assume dreadful and various appearances, i. 323—in those countries where the sun exerts the greatest force in raising vapours, there are the greatest quantity of meteors, 324—one of a very uncommon kind, seen by Ulloa at Quito, 328.

Method, the principal help in natural history; without it little progress made in this science, ii. 130—the most applauded of classing animals, 134—the author's method of classing them, 139—that of describing all things by words alone, a fault that has infected most of our dictionaries, and bodies of arts and sciences—Mr. Locke has observed, that the drawing of an animal, taken from life, is the best method of advancing natural history, 144.

Mew, said of stags when they cast their heads, ii. 312.

Mico, the least and most beautiful monkey of the sagoin kind—its description by Mr. La Condamine, iii. 316.

Microscope, increases the magnitude of an object, and that of its motion also, i. 361—the pupil and humours of the eye of the mole discovered by it, iii. 191.

Migrating (Fishes) the herring and the pilchard take the most ad-

venturous voyages—stated returns, and regular progress of the migrating fishes, one of the most extraordinary circumstances in the history of nature, v. 136.

Migration, causes of migrations of birds—in what manner they perform them—at what times—rather follow weather than country, and go on as they perceive the atmosphere more suitable to their wants and dispositions—migration of some swallows, and retreat of others into old walls, to avoid the rigour of winter, wrap this subject in great obscurity, iv. 24—of bees several signs previous to it, vi. 105.

Milk, infants have it in their own breasts, i. 391—sometimes found in the breasts of men, as well as in those of women, 424—in carnivorous animals, more sparing than in others, ii. 168—of goats, medicinal, and not apt to curdle upon the stomach, as that of the cows, 263—of the rein-deer, thinner than that of the cow, but sweeter, and more nourishing, 347—boiled up with wood-sorrel, by the Laplanders, kept in casks under ground, to be eaten in winter, 358—injected into a vein, kills with more certainty than the venom of a viper, v. 357.

Millipedes multiplied by being cut in pieces, i. 363.

Milo, an instance of his strength, i. 436.

Milton makes Satan personate the cormorant, a most nauseous bird—objection against him on this account—his vindication, iv. 365.

Minerals mere inactive and insensible bodies, i. 348.

Miners first become paralytic, then die consumptive, for the trifling reward of seven pence a day, i. 68—peculiar contrivance to supply light for their operations—make use only of wooden instruments in digging, and take out the nails from their shoes, before they enter the mine, 70.

Mines, that at Cotteberg in Hungary, three thousand feet deep, i. 46—a coal-mine in the North of England, said to be eleven hundred yards deep, 64—air different in them, proportionably as the magazines of fire lay nearer the centre—other causes of this difference,—Mendip lead-mines, in Somersetshire—their description—mines of coal generally less noxious than those of tin; tin than those of copper; but none are so dreadfully destructive as those of quicksilver—deplorable infirmities of workmen in the mines near the village of Idra, 65—metallic, often destroy all vegetation by their volatile corrosive fumes—salt mines naturally cold,—natives of countries abounding in mines, too often experience the noxious effects of their vicinity, 269—in a lead-mine in Flintshire were found two grinding-teeth, and part of the tusk of an elephant, at forty-two yards depth, iii. 356.

Mingrelians, among the sixth variety of the human species, described, ii. 85.

Mint, cats excessively fond of the cat-mint, ii. 386.

Mire-drum, the bittern described, iv. 316. See *Bittern*.
Misletoe, a plant thought propagated by seeds voided by birds, iv. 248.
Mists continually rise upon approach of the winter months, under the line, i. 324—called frost-smoke—raises blisters on several parts of the body, in the regions round the poles, 331.
Miume, a river in America—enormous skeletons lately discovered near it, iii. 356.
Mock-bird, description of the American mock-bird—its habits—can assume the tone of every animal in the wood, from the wolf to the raven—no bird in the forest it has not at times deceived by mimicking its call, iv. 254.
Mock-suns, Meteors and other phœnomena in the northern regions, i. 324.
Mococo, first of the maki-kind, which is the last of the monkies—its description—a native of Madagascar—its qualities, iii. 318—eats its own tail, and seems to feel no pain—some other monkies do the same, 397.
Mold, black, or garden-earth, the first layer on the surface of the globe—is formed from animal and vegetable bodies decayed—soil fertile, in proportion to the quantity that putrefied mold bears to the gravelly mixture, i. 47.
Mole, no quadruped fatter, none with a more sleek glossy skin——an utter stranger in Ireland—formed to live under the earth—its description—the ancients, and some moderns, of opinion, that the mole was blind; but Derham, by a microscope, discovered all the parts of the eye known in other animals—a mole let loose in the midst of a field, like a ghost on a theatre, instantly sinks into the earth; and an active labourer, with a spade, pursues it in vain—peculiar advantage of the smallness of its eyes—when once buried in the earth, it seldom stirs out—it chuses the looser, softer grounds—chiefly preys upon worms and insects—is most active, and casts up most earth, immediately before rain, and in winter before a thaw—in dry weather, it seldom forms hillocks—readily evades the pursuit of animals stronger and swifter than itself—its greatest calamity is an inundation—in some places considered by the farmer as his greatest pest—couples towards spring, and the young found about the beginning of May—generally four or five at a time—description of the mole-hill, in which the female has brought forth her young—is scarcely found, except in cultivated countries—the varieties are but few—that of Virginia is black, mixed with a deep purple—that of Poland is white—Agricola says he saw hats made of mole-skins, the finest and most beautiful imaginable, iii. 189.
Molting, annually suffered by birds—its effects—artificially accelerated, and how—the manner in which nature performs the operation, iv. 14.—the season commonly obtains from the end of summer to the middle of autumn, 16.

Mona, the *Cephus* of the ancients, a monkey of the ancient continent—its description, iii. 313.

Mongooz, of the maki kind, the last of the monkies—its description—is a native of Madagascar, iii. 313.

Monkey, they sometimes fall a prey to the lion in deserts and forests, ii. 400—one general description will not serve for all the animals of the monkey kind, iii. 277—La Condamine asserts it would take up a volume to describe the differences of monkies found along the river of Amazons; and we are sure that every one of these is different from those on the African coast—an elaborate description of each must be useless and tiresome, their numbers being very great, and their differences very trifling—those of two cantons never found to mix—of all kinds less than the baboon, have less power of doing mischief, and their ferocity diminishes with their size—do nothing desired without beating; their fears once removed, they are the most insolent headstrong animals in nature—in their native woods, are the pests of other animals, and the masters of the forest where they reside—the tiger or the lion will not venture to dispute dominion with creatures, who, from the tops of trees, with impunity carry on an offensive war, and by their agility escape all pursuit—birds have not less to fear from their continual depredations; such being their petulant delight in mischief, that they fling the eggs against the ground, when wanting appetite to devour them—one only animal in the forest ventures to oppose them, that is the serpent—larger snakes often wind up the trees where they reside, and, happening to surprize them sleeping, swallow them whole, before they can make defence—they generally inhabit the tops of trees, and the snakes cling to the branches nearer the bottom; in this manner they are near each other, like enemies in the same field of battle—some supposed their vicinity rather argued mutual friendship, 299, &c.—father Labat has seen them playing their gambols upon those branches on which the snakes were reposing, and jumping over them, without receiving any injury—they provoke the snake, as the sparrows twitter at a cat—when attacked, they shew perfect skill in defending and assisting each other—they regularly begin hostilities against those who enter their woods—they take most desperate leaps, and seldom come to the ground—one being wounded, the rest come round, put their fingers into the wound, as desirous of sounding its depth—the blood flowing in any quantity, some stop it, while others get leaves, chew, and thrust them into the opening—are often killed in numbers before they make a retreat, with the same precipitation as they at first came on—in this retreat the young are clinging to the back of the female, who jumps away, seemingly unembarrassed by the burthen—usual way of taking them alive—

the monkey, not killed outright, does not fall; but, clinging to some branch, continues, when dead, its last grasp, and remains where shot, until it drops by putrefaction—skinned and served up at negroe-feasts, so like a child, an European is shocked at the sight—the negroes seeing Europeans buy young and tame monkies, with equal care brought rats to the factors for sale, and were greatly disappointed, at finding no purchaser—negroes cannot comprehend advantages arising from educating or keeping animals, who come in companies to lay waste fields of corn or rice, or plantations of sugar-canes—they carry off what they are able, and destroy ten times more—manner of their plundering—are under a kind of discipline, exercised among themselves—account to this purpose by Margrave—one species, by Mr. Buffon, called the ouarine, remarkable for loudness and distinctness of voice—use to which they convert it—are generally together in companies, march in exact order, and obey the voice of some chieftain, remarkable for his size and gravity—chief food of the tribe—extraordinary manner of managing an oyster, 302, &c.—manner of drawing crabs from the water—no snare, however nicely baited, takes a monkey of the West-Indian islands—female brings forth one, and sometimes two, at a time—rarely breed when brought into Europe—the male and female never tired of fondling their young, and instruct it with no little assiduity—often severely correct it, if stubborn, or disinclined to profit by their example—manner of carrying their young in the woods—dexterity in passing from one tree to another, by forming a kind of chain, locking tail in tail, or hand in hand—one amused itself for hours imposing upon the gravity of a cat, and playing its pranks among rabbits—faithful services which father Carli received from the monkies in Angola, where he went to convert the savage natives to Christianity—savages of Africa and America suppose monkies to be men; idle, slothful, rational beings, capable of speech and conversation, but obstinately dumb, for fear of being compelled to labour—monkies of Africa most expert and entertaining—shew a greater degree of cunning and activity—three marks by which monkies of the new continent are distinguished from those of the old—Mr. Buffon makes but nine species of monkies belonging to the ancient continent, and eleven to the new—their names, with their descriptions—the *red African*, the *patas*, second sort of the ancient continent—the *white nose* or *moustoc*, of the ancient continent, most beautiful; its description—the *green* of St. Jago, also called *callatrix*, is of the ancient continent—its description—some of the kind eat their own tail, and seem to feel no pain—the Bramins have hospitals for those that happen to be sick, or disabled, those monkies of the new continent with muscular holding tails,

are called sapajous, and those with feeble useless tails, are called sagoins—the *fox-tailed* monkey—*makies*, the last of the kind—their description, iii. 308.

Monkey-bezoar, a factitious concrete, ii. 282. See *Bezoar*.

Monoculus, the arborescent water-flea—its description—are of a blood-red colour; and sometimes in such multitudes on standing waters, as to make them appear all over red, whence the water has been thought turned into blood—its branching arms, and the motion made with them in the water deserve great attention, v. 427.

Monſoons, so called from a famous pilot of that name, who firſt used them in navigation with success—in the ocean between Africa and India, those of the eaſt winds begin in January, and end at the commencement of June; in Auguſt, or September, the contrary takes place; and the weſt winds blow for three or four months, i.—monsoons prevail, at different seasons, throughout the Indies, 287, 308.

Monſtrous productions, father Malbranche's ingenious theory of —remarkable inſtance related by him, ii. 96.

Mooſe-deer, name in America for the elk—its description, ii. 336.

Mormyrus, description of this fish, v. 129.

Moron, a kind of salamander, thought venomous, v. 311.

Morſe, an animal of the seal kind, might be ranked among the fishes, ii. 149—generally frequents the same places where seals reside—different from the reſt in a very particular formation of the teeth—resembles a seal, except that it is much larger—are rarely found, but in the frozen regions near the Pole—formerly more numerous than at present—the Greenlanders destroyed them more before those seas were visited by European ships upon the whale fishery, than now—its teeth generally from two to three feet long—the ivory more esteemed than that of the elephant—the fishers have formerly killed three or four hundred morses at once; their bones are still lying in prodigious quantities along those shores they chiefly frequented, iii. 266.

Moschitoes, excessive torments caused by them—houses forsaken on their account, i. 123.

Moſs, the only support of the rein-deer in Lapland—of two sorts, white and black, ii. 345.

Mother-of-pearl, taken from the pearl oyster, v. 243.

Moths, difference from butterflies, vi. 72—all the tribe of female moths lay their eggs soon after they leave the aurelia, 75.

Motion, keeps the water of the sea sweet, i. 201—destroys numbers of viler creatures, 208—constant motion of the waters of the sea westward, 216—principal differences between serpentine and vermicular motion, v. 342—some vegetables possessed of motion, vi. 169—and many animals totally without it—in what manner animals of the worm kind move, 172.

Mouffion, the sheep in a savage state—its description, ii. 258.

Mountains, rising from places once level, i. 16.—give direction to the courses of the air, 280—how formed, and for what designed—upon our globe, considered as angles of small lines in the circumference of a circle, 116—countries most mountainous, are most barren and uninhabitable, 122—some vallies are fertilized by earth washed down from great heights, 137—the more extensive the mountain, the greater the river, 119—tops of the highest mountains bare and pointed, and why, 130—tops of land-mountains appear barren and rocky; of sea-mountains, verdant and fruitful, 241—the highest in Africa, those called *of the moon*, giving source to the Niger and Nile in Africa, the greatest and highest under the line, 119—some rise three miles perpendicular above the bottom of the ocean, 122—highest in Asia; mount Caucasus makes near approaches to the Andes, in South America, 128.

Mouse, the most feeble and most timid of all quadrupeds, except the Guinea-pig—never rendered quite familiar; though fed in a cage, retains its apprehensions—no animal has more enemies, and few so incapable of resistance—the owl, cat, snake, hawk, weasel, and rat, destroy them by millions—brings forth at all seasons, and several times in the year; its usual number from six to ten—these in a fortnight strong enough to shift for themselves—places where chiefly found—Aristotle, having put a mouse with young into a vessel of corn, some time after found a hundred and twenty sprung from that original—its life lasts two or three years—the species found in all parts of the ancient continent, and has been exported to the new—Gesner minutely describes the variety of mouse-traps—long-tailed field-mouse—short-tailed field-mouse—has a store against winter, a bushel at a time—a description of the shrew-mouse, iii. 173, &c.

Moustoc, or *White-nose*, monkey of the ancient continent; a beautiful little animal—its description, iii. 313.

Mucous-liquor, giving the joints an easy and ready play, ii. 59.

Mugil, the mullet, description of this fish, v. 125.

Mule, reputed barren, though Aristotle says it is sometimes prolific, ii. 199—engendered between a horse and a she-ass, or a jack-ass and mare—inhabitants of mountainous countries cannot do without them—how they go down the precipices of the Alps and Andes—a fine mule in Spain worth fifty or sixty guineas—common mule very healthy—lives thirty years and more, 207.

Mullus, or *Surmulet*, description of this fish, v. 124.

Multivalve (shells,) third division of shells by Aristotle, v. 209—two principal kinds of multivalve shell-fish, moving and stationary, 247.

Mummy, formerly a considerable article in medicine—Paræus wrote a treatise on the inefficacy of mummy in physic—counterfeited by the Jews, and how—the method of seeking for

mummies—found in the sands of Arabia, in Egypt, in wooden coffins, or in cloths covered with bitumen, ii. 121—remarkable mummy dug up at Auvergne, in France, 125—an injection of petreoleum inwardly, and a layer of asphaltum without, suffice to make a mummy, 128.

Muræna, the eel, its description, v. 126.

Murena of the ancients, v. 94.

Muscardin, name of the lesser dor-mouse, by Mr. Buffon, iii. 177.

Muscle, the shell-fish, its description—its organs of generation are what most deserve to excite our curiosity—it endeavours to become stationary, and to attach itself to any fixed object it happens to be near—its enemies—it is supposed that those threads, which are usually called the beard of the muscle, are the natural growth of the animal's body, and by no means produced at pleasure, as Reamur supposes—its instrument of motion, by which it contrives to reach the object it wants to bind itself to—its food—some of this kind have been found a foot long—the natives of Palermo sometimes make gloves and stockings of its beards—the places where found—it requires a year for the peopling a muscle-bed, v. 232.

Muscles, to judge of the strength of animals by the thickness of their muscles inconclusive, i. 437—the pectoral muscles of quadrupeds trifling, in comparison to those of birds—in quadrupeds, as in man, the muscles moving the thighs and hinder parts are strongest, while those of the arms are feeble—in birds the contrary obtains, iv. 6—those of the shark preserve their motion after being separated from the body, v. 73.

Muscovy-duck, or the *Musk-duck*, so called from its musky smell, iv. 412.

Music, said by the ancients, to have been invented from the blows of different hammers on an anvil—from the remains of ancient music, collected by Meibomius, one might suppose nothing powerful in what is lost—in all countries, where music is in its infancy, the half tones are rejected—many barbarous nations have their instruments of music; and the proportion between their notes is the same as in ours—all countries pleased with music; and where they have not skill to produce harmony, they substitute noise—its effects, the ancients give us many strange instances of them upon men and animals—and the moderns likewise—madness cured by it—remarkable instance in Henry IV. of Denmark—it is now well-known that the stories of the bite of the tarantula, and its cure by music, are all deceptions—instance of it—fishes are allured by music—horses and cows likewise, ii. 35—the elephant appears delighted with music, iii. 337—father Kircher has set the voices of some birds to music, iv. 111.

Musk, among the numerous medicines procurable from quadrupeds, none, except the musk and hartshorn, have preserved a

degree of reputation, ii. 375.—doubt whether the animal producing it be a hog, an ox, a goat, or a deer—no animal so justly the reproach of natural historians as that which bears the musk—it has been variously described, and is known very imperfectly—the description given by Grew—formerly in high request as a perfume—has for more than a century been imported from the East—is a dusky reddish substance, like coagulated blood—a grain of it perfumes a whole room—its odour continues for days, without diminution, and no substance known has a stronger or more permanent smell—in larger quantity it continues for years; and scarce wasted in weight, although it has filled the atmosphere to a great distance with its parts—the bags of musk from abroad supposed to belong to some other animal, or taken from some part of the same, filled with its blood and enough of the perfume to impregnate the rest—it comes from China, Tonquin, Bengal, and often from Muscovy—that of Thibet reckoned the best, and of Muscovy the worst, ii. 291, &c.

Musk-ox, an account of, ii. 238.

Musk-rat, three distinctions of it, iii. 179—it is called *stinkard* by the savages of Canada, 180.

Musky-smell, does not make the characteristic marks of any kind of animals, ii. 244.

Musmon, or *Mufflon*, resembles a ram, its description, ii. 258.

Myoides, a broad thin skin covering the whole upper fore-part of the body, its effect on women with child, i. 425.

N.

Nails, how formed in man, i. 423—those of some of the learned men in China longer than their fingers—savages that let them grow long, use them in flaying animals, 427.

Narwhal, the sea-unicorn—its description—errors concerning the teeth of this animal—the most harmless and peaceful inhabitant of the ocean—the Greenlanders call it the forerunner of the whale; and why—its food—is a gregarious animal—a century ago its teeth considered the greatest rarity in the world—were believed to belong to a very different animal—for some time after the narwhal was known, the deceit was continued—they far surpass ivory in its qualities, v. 46.

Natolian-goat, a remarkable variety in the goat-kind, ii. 264.

Nature lavish of life in the lower orders of creation, i. 383.—she has kindly hid our hearts from each other, to keep us in good humour with our fellow-creatures, 418—has brought man into life with more wants and infirmities than the rest of her fellow-creatures, ii. 1—in a course of ages shapes herself to constraint, and assumes hereditary deformity—instances of

it, 91—has contracted the stomachs of animals of the forest, suitable to their precarious way of living, 2—has left no part of her fabrick destitute of inhabitants, iv. 1—and by supplying a variety of appetites, has multiplied life in her productions, 59—what might have led some late philosophers into the opinion that all nature was animated, vi. 198.

Nautilus, a sea-snail, most frequently seen swimming—its shell very thin, and easily pierced, v. 227—its description—it is certain that *it* sometimes quits its shell, and returns to it again—peculiarity for which it has been most distinguished, 228.

Nazareth (bird), whether the dodo or not, is uncertain, iv. 58.

Neck, fishes have none—birds, in general, have it longer than any other kind of animals, i. 423—in women it is proportionably longer than in men, 428.

Nectarium, the part of a flower from which the honey is extracted, vi. 100.

Negroes of the Leeward Islands, by the smell alone, distinguish the foot-steps of a Frenchman from those of a negroe, ii. 46—several of them have white beards, and black hair—described—their features not deformed by art, 82—the women's breasts, after bearing one child, hang down below the navel, and are thrown over the shoulder to suckle the child at their backs, 83.—the jet black claim the honour of hereditary resemblance of our common parent—an argument sufficient to prove the contrary—two white negroes, the issue of black parents, 93—of the African coasts regard the bat with horror, and will not eat it, though ready to starve, iii. 232—happy to see numbers of monkies destroyed, because they dread their devastations, and love their flesh—cannot comprehend advantages arising to Europeans from educating or keeping monkies—and having seen young and tame monkies bought, have offered rats for sale to our factors, and been greatly disappointed at finding no purchaser, 305—distractedly fond of the flesh of the shark, v. 75—their manner of killing it, 73.

Negroland, or Nigritia—its inhabitants are the darkest of all blacks, ii. 89.

Nerves, wherever they go, or send their branches in number, these parts are soonest begun, and most completely finished, ii. 20.

Nest, of every species of birds, has a peculiar architecture—where eggs are numerous, the nest must be warm, iv. 18—different places which birds choose for their nests, 19—description of the nest of an eagle found in the Peak of Derbyshire, 69—of the bald eagle, large enough to fill the body of a cart, 72—hanging nests in Brasil, 195—made in such a manner as to have no opening but at the bottom, 196—the Chinese get those of the swallows from the rocks, and sell them in great numbers in the East Indies, where they are es-

teemed great delicacies, and eat dissolved in chicken or mutton broth, 273—that of the wasp one of the most curious objects in natural history—its description, vi. 116.

Nettles (of the sea), name given by some to the star-fish, vi. 181.

Newfoundland-dog described, iii. 17.

New Providence, one of the Bahama islands—the Philosophical Transactions give accounts of poisonous qualities in the fish found on the coast of this island—all kinds at different times dangerous; one day serving for nourishment, and the next proving fatal, v. 155.

Newton, (Sir *Isaac*) observes all birds, beasts, fishes, insects, trees, and vegetables, with their parts, grow from water; and, by putrefaction, return to water again, i. 139—discovered the true cause of the theory of the tides, 210—with peculiar sagacity discovered the cause of the remarkable tides at Tonquin, 215.

Nicola Pesce, a celebrated diver—his performances related by Kircher—he often swam over from Sicily into Calabria, carrying letters from the king—frequently known to spend five days in the midst of the waves, without any other provisions than the fish he caught there, and ate raw, i. 243.

Nightingale, a bird of the sparrow-kind, iv. 246—description of its melody by Pliny, 255—its residence—for weeks together, undisturbed, it sits upon the same tree—its nest, and eggs—its song in captivity not so alluring—Gesner says it is possessed of a faculty of talking—story related by him in proof of this assertion—its food, and in what manner they must be kept—manner of catching the nightingale, and managing them when caught—the black-cap, called by some the mock-nightingale, 257.

Nile, its course—its sources ascertained by missionaries—takes its rise in the kingdom of Goam—receives many leſſer rivers—Pliny mistaken in saying that it received none—the cause of its annual overflowings—time of their increase and decrease more inconsiderable now than in the time of the ancients, i. 178—Mr. Bruce's account of its source and progress, 179.

Noiſe, the mind predisposed to joy, noise fails not to increase into rapture—and those nations which have not skill enough to produce harmony, readily substitute noise—loud and unexpected, disturbs the whole frame; and why, ii. 37.

Noſe, that of the Grecian Venus such as would appear at present an actual deformity, i. 403—the form of the nose, and its advanced position, peculiar to the human visage—among the tribes of savage men, the nose is very flat—a Tartar seen in Europe with little more than two holes through which to breathe, 413—whence originally may have come the flat noses of the blacks, ii. 92.

Nostrils, wide, add a great deal to the bold and resolute air of the countenance, i. 413.

Note of the sloth, according to Kircher, an ascending and descending hexachord, uttered only by night, iii. 405.

Notonecta, the common water-fly—swims on its back, to feed on the under-side of plants growing in water, vi. 35.

Numidian-bird, or Guinea-hen, described, iv. 148.

Numidian-crane, its peculiar gestures and contortions, iv. 308.

Nux-vomica, ground and mixed with meal, the most certain poison, and least dangerous, to kill rats, iii. 172—fatal to most animals, except man, iv. 131.

Nyl-ghaw, an animal between the cow and the deer, native of India—its description—disposition and manners of one brought over to this country—its manner of fighting—at all our settlements in India they are considered as rarities, iii. 383, &c.

O.

Objects, we see them in an inverted position, ii. 20—not the feeling only, but the colour and brightness of objects, contribute to form an idea of the distance at which they appear—the power of seeing objects at a distance rarely equal in both eyes—in near-sighted persons, the best eye sees every object the largest, ii. 28.

Ocean occupies considerably more of the globe than the land, i. 190.—its different names—all the rivers in the world flowing into it, would, upon a rude computation, take eight hundred years to fill it to its present height, 191—savages consider it as an angry deity, and pay it the homage of submission, 194—when England loses its superiority there, its safety begins to be precarious, 195—the bays, gulphs, currents, and shallows of it much better known and examined than the provinces and kingdoms of the earth, and why—opinions concerning its saltness, and that of Boyle particularly, 196—winds never change between the tropics in the Atlantic and Ethiopic Oceans, 281—each has its insects—and its vegetables, 350.

Ocelot, or cat-a-mountain, its description—of the panther-kind—one of the fiercest, and, for its size, one of the most destructive animals in the world—its unceasing appetite rather for the blood than the flesh of their prey—it generally is on the tops of trees, like our wild cats, ii. 434.

Ocotzimtzcan, a kind of pigeon, one of the most splendid tenants of the Mexican forests, iv. 132.

Odours, diffused by the air as the fluid they swim in, i. 277.

Ohio, several enormous skeletons, five or six feet beneath the

surface, on the banks of that river, lately discovered, iii. 356

Oil, train-oil the drink of the Laplanders, ii. 74—the oil of the fish cachelot is very easily converted into spermaceti, v. 52—the porpoise yields a large quantity of it, 58—the liver of the shark affords three or four quarts of oil, 75—by the application of sallad-oil, the viper's bite is effectually cured, v. 361.

Olive (colour), the Asiatic of that colour claims the honour of hereditary resemblance to our common parent—an argument sufficient to prove the contrary, ii. 92.

Oliver (William) the first who discovered that the application of sallad-oil cured the viper's bite effectually, v. 361.

Onager, or the wild ass, is in still greater abundance than the wild horse, ii. 199.

Ondatra, one of the three distinctions of the musk-rat—a native of Canada—creeps into holes where others seemingly less cannot follow—the female has two distinct apertures, one for urine, the other for propagation—this animal in some measure resembles the beaver—its manner of life during winter, in houses covered under a depth of eight or ten feet of snow—savages of Canada cannot abide its scent, call it stinkard—its skin very valuable, iii. 179.

Onza, or ounce, of the panther-kind, ii. 427—the onca of Linnæus, 428.

Ophidium, the gilt-head, by sailors called the dolphin, its description, v. 122.

Opposium, an animal in North and South America, of the size of a small cat, and of the monkey-kind—its description—the young when first produced are very small, and immediately on quitting the real womb, they creep into the false one, but the time of continuance is uncertain—Ulloa has found five young hidden in the belly of the dam, alive and clinging to the teat, three days after she was dead—chiefly subsists upon birds, and hides among the leaves of trees, to seize them by surprize—cannot run with any swiftness, but climbs trees with great ease and expedition—it often hangs by the tail, and for hours together, with the head downwards, keeps watching for its prey—by means of its tail, flings itself from one tree to another, hunts insects, and escapes its pursuers—eats vegetables as well as animal substances—is easily tamed, but a disagreeable domestic, from its stupidity, figure, and scent, which, though fragrant in small quantities, is ungrateful when copious—during its gestation, the bag in which the young are concealed may be opened and examined without inconvenience; the young may be counted and handled; they keep fixed to the teat, and cling as firm as if they made a part of the body of the mother, iii. 322, &c.

Orb, description of the sea-orb, also called the sea-porcupine—is absolutely poisonous, if eaten, v. 110.
Ore of tin is heavier than that of other metals—the basest ores in general the most beautiful to the eye, i. 64.
Organs of digestion, in a manner, reversed in birds, iv. 12.
Ortolan, a bird of the sparrow kind, iv. 247.
Osprey, its flesh is admired by many, and, when young, an excellent food, according to Belonius, iv. 64—it chiefly lives upon fish, 71—its distinctive marks, 73.
Ostracion, a fish of the cartilaginous kind, is poisonous, v. 110.
Ostrich, manner in which the Arabians hunt them, ii. 177, and iv. 45—an Arabian horse of the first speed scarcely outruns them, ii. 177—the greatest of birds, makes near approaches to the quadruped class, 8—its flesh proscribed in Scripture as unfit to be eaten—its description—appears as tall as a man on horseback—brought into England above seven feet high—surprising conformation of its internal parts—a native only of the torrid regions of Africa—not known to breed elsewhere than where first produced—places they inhabit—the Arabians say it never drinks—will devour leather, glass, hair, iron, stones, or any thing given—in native deserts lead an inoffensive social life. Thevenot affirms the male keeps to the female with connubial fidelity—thought much inclined to venery—some of their eggs weigh fifteen pounds, iv. 37—season for laying depends on the climate where the animal is bred—these birds very prolific, and lay from forty to fifty eggs at one clutch—none has a stronger affection for her young, nor watches her eggs with greater assiduity, sit on them, like other birds, male and female by turns—assiduous in supplying the young with grass, and careful to defend them, encountering every danger boldly—way of taking them among the ancients—the plumes used in their helmets—the ladies of the East use them as ornaments in their dress—plumes used in Europe to decorate our hearses and hats—feathers plucked from the animal while alive more valued than those taken when dead—some savage nations of Africa hunt them for their flesh—Heliogabalus had the brains of six hundred dressed in one dish—a single egg sufficient entertainment for eight men—eggs well tasted, and extremely nourishing—Apicius gives a receipt of sauce for the ostrich—of all chaces, that of the ostrich, though most laborious, the most entertaining—use they make of its skin—method of hunting of the Struthophagi—its blood mixed with the fat a great dainty with the Arabians—inhabitants of Dara and Lybia breed flocks of them—tamed with little trouble—prized for more than feathers in their domestic state—often ridden upon and used as horses—Moore assures he saw a man at Joar travelling upon an ostrich; and Adanson asserts he had two young ostriches, the strongest of which ran swifter than the best English racer,

with two negroes on his back—of all animals using wings with legs in running, these by far the swiftest—parts of it convertible to medicinal purposes—eggs, worst of all to be eaten according to Galen—the American ostrich, 43, &c.

Otter of Roses, a modern perfume, valued for its vegetable fragrance, iii. 108.

Otter, the link between land and water animals, resembles terrestrial in make, and aquatic in living—swims faster than it runs—is brown, and like an overgrown weasel—its description—voracious animal, found near lakes—not fond of fishing in running water, and why—when in rivers, always swims against the stream, to meet rather than pursue the fish it preys upon—in lakes, destroys more than it devours, and spoils a pond in a few nights—tears to pieces the nets of the fishers—two different methods of fishing practised by it—infects the edges of lakes with the dead fish it leaves—often distressed for provisions in winter, when lakes are frozen, and then obliged to live upon grass, weeds, and bark of trees—its retreat the hollow of a bank made by the water—there it forms a gallery several yards along the water—how it evades the fowler—time of coupling—description of its habitation—way of training it up to hunt fish, and, at the word of command, drive them up to the corner of a pond, seize the largest, and bring it in its mouth to its master—to take an old otter alive not easy—few dogs dare to encounter it—marks of its residence—bites with great fierceness, and never lets go its hold—brings forth its young under hollow banks, upon beds of rushes, flags, or weeds—manner of taking the young alive—how fed when taken—continues long without food—couples about Midsummer in Europe, and brings forth at nine weeks end, three or four at a time—some dogs trained up to discover its retreat—otters met with in most parts of the world—in North America and Carolina found white, inclining to yellow—description of the Brasilian otter, iii. 237.

Ovaria, two glandular bodies near the womb, resembling the cluster of small eggs found in fowls, i. 358.

Ovarine species of monkies so called by Mr. Buffon, remarkable for the loudness of their voice, and the use to which they apply it, iii. 307.

Oviparous animals, distinguished from the viviparous, the two classes for generation; all other modes held imaginary and erroneous, i. 362.

Ourang-outang, the wild man of the wood, an animal nearly approaching the human race, is the foremost of the ape-kind—this name given to various animals walking upright; but of different countries, proportions and powers—the troglodyte of Bontius, the drill of Purchas, and the pigmy of Tyson have received this general name—its description in a comparative view with man—gigantic races of it described by travellers

truly formidable—many are taller than man, active, strong, intrepid, cunning, lascivious, and cruel—countries where found—in Borneo the quality course him as we do the stag, and this hunting is a favourite amusement of the king—runs with great celerity—its description—Battel calls him pongo; assures us that in all he resembles man, but is larger to a gigantic state—a native of the tropical climates—he lives upon fruits, and is not carnivorous—goes in companies; and this troop meeting one of the human species without succour, shew him no mercy—they jointly attack the elephant, beat him with clubs, and force him to leave that part of the forest they claim as their own—is so strong, that ten men are not a match for it—none of the kind taken but very young—one of them dying, the rest cover the body with leaves and branches—a negro boy taken by one of these, and carried into the woods, continued there a whole year without any injury—they often attempt the female negroes going into the woods, and keep them against their wills for their company, feeding them plentifully all the time—a traveller assures us, that he knew a woman of Loango that lived among them for three years—they build sheds, and use clubs for their defence—sometimes walk upright, and sometimes upon all fours when phantastically disposed—though it resembles man in form, and imitates his actions, it is inferior in sagacity even to the elephant or the beaver—two of these creatures brought to Europe discovered an astonishing power of imitation, sate at table like men, ate of every thing without distinction, made use of knife, fork, and spoon, drank wine and other liquors—the male of these two creatures being sea-sick, was twice bled in the arm; and afterwards, when out of order, he shewed his arm as desirous of relief by bleeding—another was surprisingly well behaved, drank wine moderately, and gladly left it for milk or other sweet liquors—it had a defluxion upon the breast, which, encreasing, caused its death in the space of one year from its arrival, iii. 277, &c.

Ounce, or onza, remarkable for being easily tamed, and employed all over the East for the purposes of hunting, ii. 289 distinguished from the panther, the onca of Linnæus, 428—does not pursue by the smell like the dog kind—manner of hunting with it, 432—the hyæna attacks it, and seldom fails to conquer, iii. 65.

Owl, description of the common horned-owl—the screech-owl, and its distinctive marks, iv. 64—common mark by which all birds of this kind are distinguised from others—general characteristics of birds of the owl-kind—though dazzled by a bright day-light, they do not see best in darkest nights, as imagined—seasons in which they see best—nights of moonlight the times of their successful plunder—seeing in the night, or being dazzled by day, not alike in every species of this

kind—instances in the white, or barn-owl, and in the brown horned-owl—description of the great horned-owl—names of several owls without horns—these horns nothing more than two or three feathers that stand up on each side of the head over the ear—times of making their excursions—places where found in the day-time—father Kircher having set the voices of birds to music, has given all the tones of the owl note, which make a most tremendous melody—sometimes bewildered—what they do in that distress—aversion of small birds to the owl—how they injure and torment him in the day-time—an owl appearing by day sets a whole grove in an uproar—small birds sometimes hunt the owl until evening, when recovering sight, he makes the foremost pay dear for their sport, and does not always leave man an unconcerned spectator—sport of bird-catchers, by counterfeiting the cry of the owl—in what manner the great horned-owl is used by falconers to lure the kite, when wanted for training the falcon—places where the great horned-owl breeds—its nest, and number of eggs—the lesser owl takes by force the nest of some other bird—number of eggs—the other owls build near the place where they chiefly prey—a single owl more serviceable than six cats, in ridding a barn of mice—an army of mice devoured at Hallontide by a number of strange painted owls—are shy of man, extremely untractable, and difficult to tame—the white owl in captivity refuses all nourishment, and dies of hunger—account of Mr. Buffon to this purpose, iv. 106, &c.

Ox, on the fertile plains of India it grows to a size four times as large as the same kind bred in the Alps, ii. 91—one in England sixteen hands high; its growth depends on the richness of pasture, 227.

Oysters, a horse known to be fond of oysters, ii. 160—surprising manner in which monkies manage an oyster, iii. 308—bivalved shell-fish, are self-impregnated—the particulars in which they differ from the muscle—growing even amidst branches of the forest—have no other seeming food than the afflux of sea-water—they are deposited in beds where the tide comes in, at Colchester, and other places of the kingdom—these said to be better tasted—amazing size of oysters along the coast of Coromandel, v. 237—the pearl oyster has a large whitish shell, the internal coat of which is the mother-of-pearl, 242.

P.

Paca, improperly called American rabbit, an animal of South America—its cry, and manner of eating—is most like the agouti, yet differs in several particulars—its description—places where generally found—it flesh considered a delicacy, and eaten, skin and all, like a young pig—is seldom taken

alive, defending itself to the last extremity—persecuted not only by man but by every beast and bird of prey—breeds in such numbers the diminution is not perceptible, iii. 158.

Pachomac (deserts), where the formidable bird condor is chiefly seen, men seldom venture to travel; hissing serpents, and prowling panthers, being the scattered inhabitants, iv. 81.

Pacific-sea, the winds never change in it, i. 281.

Pacos, a kind of camel in South America—its wool very valuable, iii. 382.

Paddock-moon, the silence of frogs in dry weather may serve to explain an opinion, that there is a month in the year so called, in which they never croak, v. 268.

Pain, nothing but repeated experience shews how seldom pain can be suffered to the utmost, ii. 69.

Painters never fully imitate that bold relievo, which both eyes give to the object, ii. 23.

Paleness often the effect of anger, and almost ever the attendant of fright and fear, i. 417.

Palm-tree, its juice drank by the rousette, or the great bat of Madagascar, iii. 233—the elephant eats the shoots, leaves, and branches to the stump, 338.

Pangolin, vulgarly the scaly lizard, is a native of the torrid climates of the ancient continent—of all animals, the best protected from external injury—its description—at the approach of an enemy, it rolls itself up like the hedge-hog—the tiger, panther, and hyæna, make vain attempts to force this animal, when it rolls itself up like the hedge-hog—its flesh is considered by the Negroes of Africa as a great delicacy—it has no teeth—lives entirely upon insects—there is not a more harmless, inoffensive creature, than this, unmolested—cunning in hunting for its prey—chiefly keeps in the obscure part of the forests—its tongue, when extended, is shot out about a quarter of a yard beyond the tip of the nose—countries were found, iii. 214.

Panther, it naturally hunts the sheep and the goat, ii. 154—the foremost of the mischievous spotted kind, by many naturalists mistaken for the tiger—the panther of Senegal—the large panther—difference between these two—that of America, or Jaguar, compared with the two former, 423—sometimes employed in hunting—the gazelle, or leveret, are its prey—it sometimes attacks its employer, 432—attends to the call of the jackall, iii. 58.

Parr, a peasant, lived to an hundred-and-forty-four, without being abstemious, ii. 63.

Paradise-bird, few have more deceived and puzzled the learned than this—it is an inhabitant of the Molucca islands—erroneous reports concerning this bird, and what has given rise to them—the native savages of those islands carefully cut off its legs before they bring it to market, and why—two kinds of

the bird of Paradise—their distinction from other birds—the description of this bird—found in great numbers in the island of Aro, where the inhabitants call it God's bird—live in large flocks, and at night perch upon the same tree—are called by some the swallows of Ternate, and, like them, have their stated times of return—their king distinguished from the rest by the lustre of his plumage, and the respect and veneration paid to him—killing the king is the best chance of getting the flock—chief mark to know the king is by the ends of the feathers in the tail, having eyes like those of the peacock—a number of these birds taken, the method is to gut them, cut off their legs, dry the internal moisture with a hot iron, and fill the cavity with salt and spices, then sell them to the Europeans for a mere trifle—how this bird breeds, or what the number of its young, remains for discovery—for beauty, it exceeds all others of the pie kind, iv. 199.

Parakeets, a kind of parrot of a lesser size, iv. 215—of that kind in Brafil, Labat assures us, they are the most beautiful in plumage, and the most talkative birds in nature, 221. See *Parrot.*

Parasite-plants, not able to support themselves, grow and fix upon some neighbouring tree, i. 349.

Parrot, the middle or second size of the kind, described—the ease with which this bird is taught to speak, and the number of words it is capable of speaking, are surprising—a grave writer affirms, that one of these was taught to repeat a whole sonnet from Petrarch—the author has seen one taught to pronounce the ninth commandment articulately—account of a parrot belonging to King Henry VII. which fell into the Thames, crying, *A boat, twenty pound for a boat*—Linnæus makes its varieties amount to forty-seven; Brisson extends his catalogue to ninety-five; and the author thinks them numberless—assertion, that the natives of Brasil by art change the colour of a parrot's plumage—peculiarities observed in their conformation—common enough in Europe; will not, however, breed here—lose spirits and appetite during the rigour of winter—instances of sagacity and docility, particularly of the great parrot, called aicurous—their habits—their nests, and the number of eggs—usual method of taking the young—always speak best, when not accustomed to harsh wild notes—what fruit or grain these birds feed upon their flesh partakes of the flavour and taste—instances of it—seed of the cotton-tree intoxicates them, as wine does man—wine renders them more talkative and amusing—in France very expert, but nothing to those of Brasil, which Clusius says are most sensible and cunning—natives of Brasil shoot them with heavy arrows, headed with cotton, which knock down the bird without killing it—those of the parakeet tribe are delicate eating—of this kind in Brasil, Labat assures they are

the most beautiful in plumage, and the most talkative possible—are restless, and ever on the wing—their habits—their outcry when their companions fall—are very destructive on the coast of Guinea—more than a hundred different kinds counted on the coast of Africa—the white sort called lories—countries where found—one, north of the Cape of Good Hope, takes its name from the multitude of parrots in its woods—a hundred kinds now known, not one of which naturally breeds in countries that acknowledged the Roman power—the green parakeet, with a red neck, was the first of the kind brought into Europe, and the only one known to the ancients, from Alexander the Great to Nero—disorders peculiar to the parrot kind—one well kept will live five or six-and-twenty years, iv. 212.

Parsley, pinks, and birch, hares are particularly fond of, iii. 121.

Partridges, in England, a favourite delicacy at the tables of the rich, whose desire of keeping them to themselves has been gratified with laws for their preservation, no way harmonizing with the general spirit of English legislation, and why—there are two kinds, the grey and the red; the grey is most prolific, and always keep on the ground; the red less common, and perches upon trees—the partridge is found in every country and climate—in Greenland, where it is brown in summer, it becomes white in winter—those of Barakonda are larger legged, swifter of foot, and reside in the highest rocks—partridges of all sorts agree in one character, being immoderately addicted to venery; often to an unnatural degree—the male pursues the hen to her nest, and breaks her eggs, rather than be disappointed—the young having kept in flocks during the winter, break society in spring, when they begin to pair; and terrible combats ensue—their manners otherwise resemble those of poultry, but their cunning and instincts are superior—means the female uses to draw away any formidable animal that approaches her nest—the covies from ten to fifteen, and, unmolested, they live from fifteen to seventeen years—method of taking them in a net with a setting-dog the most pleasant, and most secure—they are never so tame as our domestic poultry, iv. 157.

Passions, most of the furious sort characterized from the elevation and depression of the eye-brows, i. 410—freedom from passions not only adds to the happiness of the mind, but preserves the beauty of the face, 60.

Pastures, those of Great Britain excellently adapted to quadrupeds of the cow kind, ii. 224.

Patas, by some called the red African monkey—its description, iii. 312.

Paunch, name of the first stomach of ruminating animals, ii. 219.

Pazan, name of the eighth variety of gazelles, by Mr. Buffon, ii. 280.

Peacock, a saying among the ancients, as beautiful as is the peacock among birds, so is the tiger among quadrupeds, ii. 409—varieties of this bird—some white, others crested—that of Thibet the most beautiful of the feathered creation—our first were brought from the East Indies; and they are still found in flocks in a wild state in the islands of Java and Ceylon—the common people of Italy say it has the plumage of an angel, the voice of a devil, and the guts of a thief—in the days of Solomon, we find his navies imported from the East apes and peacocks—Ælian relates, they were brought into Greece from some barbarous country; and that a male and female were valued at thirty pounds of our money—it is said, also, that when Alexander was in India, he saw them flying wild on the banks of the river Hyarotis, and was so struck with their beauty, that he laid a fine and punishment on all who should kill or disturb them—the Greeks were so much taken with the beauty of this bird, when first brought among them, that it was shewn for money; and many came to Athens from Lacedæmon and Thessaly to see it—once esteemed a delicacy at the tables of the rich and great—Aufidius Hurco stands charged by Pliny with being the first who fatted up the peacock for the feasts of the luxurious—Hortensius, the orator, was the first who served them up at an entertainment at Rome; and they are talked of as the first of viands—in the times of Francis I. it was a custom to serve up peacocks to the tables of the great, not to be eaten, but seen; in what manner they served them—its flesh is said to keep longer unputrefied than any other—has a predilection for barley; but, as a proud and fickle bird, there is scarce any food it will at all times like—it strips the tops of houses of tiles or thatch, lays waste the labours of the gardener, roots up the choicest seeds, and nips favourite flowers in the bud—is still more salacious than the cock—requires five females at least to attend him; and, the number not sufficient, will run upon and tread the sitting hen—the peahen, as much as possible, hides her nest from him, that he may not disturb her sitting—she seldom lays above five or six eggs in this climate—Aristotle describes her laying twelve—in forests where they breed naturally, they are very numerous—this birds lives about twenty years; and not till the third year has that beautiful variegated plumage of its tail—in the kingdom of Cambaya, says Taverner, near the city of Baruch, whole flocks of them are in the fields—description of their habits—decoy made use of to catch them there, iv. 132, &c.

Peacock, (sea) a name given, and by which has been described, the Balearic-crane, from some resemblance in disposition and manner, iv. 305.

Pearl, an animal substance concreted and taking a tincture from the air—found in all bivalved shells, the inside of which resemble that substance called mother-of-pearl—the formation of pearls a disease or an accident in the animal, is not known—common opinion upon this subject—the pearl bred from no disorder in the animal—*pearl-oyster*, from which the mother-of-pearl is taken—several pearl-fisheries—the chief of them in the Persian Gulph, and the most valuable of pearls brought from thence—different sizes, figures, and colours—whence their different colours proceed—pearls converted by time and damps into a chalky powder—wretched people destined to fish for pearls—usually die consumptive—in what manner they fish for them, v. 242.

Pearls, in stags, are parts rising from the crust of the beam, ii. 312.

Pecary, or *tajacu*, an animal, a native of America, at first view resembling a small hog—its description—has upon the back a lump like the navel in other animals—it consists of glands producing a liquor of an offensive smell—when killed, the parts of generation, and the glands on the back, must be taken instantly away, otherwise in half an hour the flesh becomes unfit to be eaten—though like the hog, in many respects, is nevertheless a distinct race, and will not mix or produce an intermediate race—is easily tamed—goes in herds of two or three hundred, and unite, like hogs, in each other's defence—delights not in marshes or mud, like our hogs—an unceasing enemy to the lizard, the toad, and the serpent kinds—also feeds upon toads and serpents—any plunderer seizing their young, is surrounded, and often killed, ii. 367.

Pedigree, the Arabians preserve that of their best horses with great care, and for several generations back, ii. 178.

Pelagii, the Latin name for those shells fished up from the deep—those cast on the shore are the littorales, v. 210.

Pelican, a native of Africa and America; once known in Europe, particularly in Russia—fabulous accounts propagated of it—the description of it, particularly of its bill, and the great pouch underneath, as wonderful—Tertre affirms the pouch will hide flesh enough to serve sixty hungry men for a meal—this pouch, placed at the top of the gullet, considered as the crop in other birds—the description of the bird, from father Labat—indolent habits in preparing for incubation, and defending their young—their gluttony scarcely to be satisfied; their flesh rancid, and tastes worse than it smells—use made by the Americans of their pouches—is not entirely incapable of instruction in a domestic state—instances of it—Aldrovandus mentions one believed to be fifty years old, iv. 353.

Penguin, union between this bird and the albatross, and regularity in their building together, iv. 362—a heavy water-fowl—the wings of this tribe unfit for flight; and their legs still more aukwardly adapted for walking—our sailors call

them arse-feet—they dive to the bottom, or swim between two waters—they never visit land but when coming to breed—their colour—are covered more warmly with feathers than other birds—description of the Magellanic-penguin—they unite in them the qualities of men, fowls, and fishes—instances of its gluttonous appetite—their food and flesh—are a bird of society—season of laying, and manner of making their nests—some of this tribe called by our seamen the booby—our men first coming among them, were not distrusted or avoided; they stood to be shot at in flocks, till every one was destroyed—the females let them take their eggs without any resistance—the penguin lays but one egg—in frequented shores—burrows like a rabbit—three or four take possession of one hole, and hatch—one is placed as a centinel to warn of approaching danger, 382.

Peninsula (of India), on one side the coasts are near half the year harrassed by violent hurricanes and northern tempests, i. 287—the people there employ the elephant chiefly in carrying or drawing burthens, iii. 353.

Penpark-hole, in Gloucestershire, twenty-five fathom perpendicular depth—its description, from captain Sturmey, i. 58.

Pepper, the Indians prefer that devoured and voided unconcocted by the toucan, before the pepper fresh gathered from the tree, iv. 188.

Perch, a prickly-finned thoracic fish—its description, v. 124.

Perfumes, some physicians think all perfumes unwholesome—our delight in perfumes seems made by habit—many bodies at a distance give an agreeable perfume, and nearer have a most ungrateful odour, ii. 48—no perfume has a stronger or more permanent smell than musk, 292—the scent of the martin a most pleasing perfume, iii. 87—some of the weasel kind have a smell approaching to perfume, 98—that of the musk or the civet is nothing to the odour of the stinkards, 99—in what manner taken from the pouch—more grateful perfume than musk—that of Amsterdam the purest of any—is communicated to all parts of the animal's body; the fur impregnated, and the skin also—a person shut up with one of the skins in a close room, cannot support the scent—this perfume sold in Holland for about fifteen shillings an ounce—it has no analogy with the creature's appetite for generation—a proof of it—has its vicissitudes of fashion, like dress, 107.

Persia, the horses of that country the most beautiful and most valuable of all in the East, ii. 188—there are studs of ten thousand white mares together, with the hoof so hard that shoeing is unnecessary, 183—the flesh of the wild ass so much liked that its delicacy is a proverb there, 201—two kinds of asses there, and some of them worth forty or fifty pounds, 207—a noted country for giving long soft hair to the animals bred in it, 390—lions found to diminish in number in this

country, 393—the bird of Persia is the common cock of Aristophanes, iv. 124.

Persian Gulph, a very dangerous wind prevails, by the natives called the sameyel—it suddenly kills those it involves in its passage, and frequently assumes a visible form, darting in a blueish vapour along the surface of the country—the poets of Persia and Arabia have described it as under the conduct of vengeance, who governs its terrors, and raises or depresses it, as she thinks proper, i. 296—the chief pearl fishery carried on there, v. 244—that gulph choaked up in many places with coralline substances, vi. 193.

Perspiration, an experiment from which the learned may infer upon what foundation the doctrine of Sanctorian perspiration is built, i. 430.

Peruvians, father Acosta, and Garcilasso de la Vega, make no doubt but that they understood the art of preserving their dead for a long space of time, ii. 118.

Petrel, or gull, described, iv. 372.

Petreoleum, an injection of this bituminous oil inwardly, and an application of asphaltum without, suffice to make a mummy, ii. 128.

Pettichaps, a bird of the sparrow kind, iv. 247.

Phalanger, a kind of oppossum—its description—has been called the rat of Surinam, iii. 327.

Phatagin, an animal less than the pangolin—the extent of its tail above twice the length of its body—countries where it is to be found, iii. 218.

Pheasants, at first propagated among us, brought into Europe from the banks of the Phasis, a river of Colchis, in Asia Minor, whence they still retain their name—Crœsus, king of Lydia, seated on his throne, adorned with the barbarous pomp of eastern splendour, asked Solon whether he ever beheld any thing so fine? Solon replied, that having seen the beautiful plumage of the pheasant, no other finery could astonish him—description of this beautiful bird—its flesh the greatest dainty—animals of the domestic kind, once reclaimed, still continue domestic, and persevere in the habits and appetites of willing slavery; but the pheasant, taken from its native warm retreats, still continues his attachment to native freedom; and, wild among us, is an envied ornament of our parks and forests, where he feeds upon acorns and berries—in the woods the hen pheasant lays from eighteen to twenty eggs in a season; but in a domestic state seldom above ten—when wild, she hatches and leads up her brood with patience, vigilance, and courage; but when tame she never sits well; and a common hen becomes her substitute; and as for leading her young to their food, she is utterly ignorant where it is found—and the young would starve if left solely to her management—it is better left at large in the woods than re-

duced to its pristine captivity—its fecundity, when wild, is sufficient to stock the forest, and its flesh acquires a higher flavour from its unlimited freedom—its habits, when tame—no birds are shot more easily—when physicians of old spoke of wholesomeness of viands, the comparison lay with the flesh of the pheasant—these birds taken young into keeping, become as familiar as chickens; and when designed for breeding, they are put together in a yard, five hens to a cock—their nest in its natural state—the female refusing to hatch the eggs, a common hen supplies her place, and performs the task with perseverance and success—the young difficult to be reared—with what food the young must be supplied—particularities concerning the rearing of the young ones—the method of Longolius to encrease the breed and make it more valuable—the pheasant will at last be brought to couple with a common hen—many varieties of pheasants; of all others, the *golden pheasant* of China the most beautiful, iv. 142, &c.

Pholades, the file-fish, places where these animals are found—their power of penetrating—the pillars of the temple of Serapis at Puteoli were penetrated by them—they pierce the hardest bodies with their tongue—their motion slow beyond conception—have no other food but the sea-water—are accounted a great delicacy, v. 250.

Pie, in the class of the pie kind, few, except the pigeon, are of use to man; yet, to each other, no class of birds so ingenious, active, and well-fitted for society—they live in pairs, and their attachments are confined to each other—they build nests in trees or bushes; the male shares in the labour of building, and relieves his mate in the duties of incubation; and the young once excluded, both are equally active in making them ample provision—general laws prevail, and a republican form of government is established among them—they watch for the general safety of every bird of the grove—they are remarkable for instinct and capacity for instruction—instances of it—fetching and carrying untaught, all this tribe are but too fond of—their passion for shining things, and such toys as some of us put a value upon—rings found in the nest of a tame magpie—the few general characters in which they all agree, iv. 169.

Pie, (sea) breeds in this country, and resides in its marshy parts, iv. 337.

Pigeons, bred to a feather, means of display of art by those persons who employ themselves in rearing pigeons of different colours, ii. 99—those that live in a wild state by no means so fruitful as those in our pigeon-houses nearer home—the tame pigeon, and all its beautiful varieties, owe their origin to one species, the stock-dove—colours of the pigeon in a state of nature—the dove-house pigeon breeds every month—the hatching of its eggs—a full explanation of the method of feed-

ing their young from the crop—various names of tame pigeons—attempts made to render domestic the ring-dove, but hitherto fruitless—the turtle-dove a bird of passage—a pair put in a cage, and one dying, the other does not survive—the pigeon called ocotzimtzan is one of the most splendid tenants of the Mexican forests—pigeons of the dove-house not so faithful as the turtle-dove—two males quarrel for the same mistress; and when the female admits the addresses of a new gallant, her old companion bears the contempt with marks of displeasure, abstains from her company, or when he approaches is sure to chastise her—instances of two males displeased with their mates, who have made an exchange, and lived in harmony with their new companions—near fifteen thousand pigeons may in four years be produced from a single pair—the stock-dove seldom breeds above twice a year—have a stronger attachment to their young than those who breed so often—the pigeons called carriers used to convey letters, not trained with as much care as formerly, when sent from a besieged city to those coming to relieve it—in an hour and a half, they perform a journey of forty miles—the only use now made of them is to be let off at the place of execution, when the cart is drawn away, iv. 224, &c.

Pigmy, existence of a pigmy race of mankind founded in error or in fable, ii. 100.

Pigtail is the last of the baboons—Mr. Buffon calls it maimon—its description—is a native of Sumatra, not well enduring the rigours of our climate, iii. 299.

Pike, the description of this fish, v. 128—poets have called it the tyrant of the watery plain—instances of their rapacity, 152.

Pilchards, little differing from the herring—make the coast of Cornwall their place of resort—the natives sometimes enclose a bay of several miles extent with nets called faines—how directed, some years ago, to know where to extend the nets—they take twelve or fifteen hundred barrels of pilchards at a draught—serve also for manure—advantages of this fishery—money paid for pilchards exported has annually amounted to near fifty thousand pounds, v. 143.

Pillau, on the Baltic, the shores near that place divided into districts for the sturgeon fishery, and allotted to companies of fishermen, who rent some of them at three hundred pounds a year, v. 100.

Pilori, one of the three distinctions of the musk-rat—it is a native of the West-India islands, iii. 179.

Pilot of the shark, name given the sucking-fish or remora, and why, v. 74.

Pinch, name of a monkey of the sagoin-kind—its description, iii. 316.

Pinks, hares are particularly fond of them, as of parsley and birch, iii. 121.

Pintada, or the Guinea-hen, its description—different names given to this bird—its habits—the eggs are speckled, iv. 147.

Pintail, a kind of duck, has the two middle feathers of the tail three inches longer than the rest, iv. 411.

Pipal, the Surinam-toad, an extraordinary and hideous creature—its description—the young bred and hatched on its back, v. 285.

Pipe-fish, cartilaginous and not thicker than a swan-quill—its description, v. 108.

Pipes, conducting water, upon what principle they depend—why those in London are extremely apt to burst, i. 156.

Pipe-worms, and other little animals, fix their habitations to the oyster's sides, and live in security, v. 238.

Pithekos, name given by the ancients to the ape properly so called, iii. 291.

Pivot, the razor shell, its motion and habits—is allured by salt, v. 241.

Plague, not well known whence it has beginning—is propagated by infection—some countries, even in the midst of Africa, never infected with it—others generally visited by it once a year, as Egypt—not known in Nigritia—Numidia it molests not once in a hundred years—plague spread over the world in 1346, after two years travelling from the great kingdom of Cathay, north of China, to Europe—the plague desolated the city of London in 1665—its contagious steams produced spots on the walls—for this last age it has abated its violence even in those countries where most common, and why—a plague affected trees and stones, i. 270, 272.

Plaster (of Paris) finely powdered boils and heaves in great waves, like water, i. 153.

Planets, some of them exceed the earth a thousand times in magnitude—at first supposed to wander in the heavens without fixed paths—perform their circuits with great exactness and strict regularity—lesser planets atendants upon some of the greater, i. 3.

Plants and vegetables, will not grow so fast in distilled as undistilled water, i. 141—smell of some so powerful as hardly to be endured, 184—plants, submarine, corals, and other vegetables, covering the bottom of the sea, 239—do not vegetate in an exhausted receiver, 260—but thus ceasing to vegetate, keep longer sweet than when exposed to external air, 261—their juices rarefied principally by the sun, to give an escape to their imprisoned air, 280—a certain plant in Ireland so strongly affected the person who beat it in a mortar, and the physician present, that their hands and faces swelled to an enormous size, and continued tumid for some time after, 270

—compared with animals, similitude—how assimilated in different climates and soils—the sensitive, that moves at the touch, has as much perception as the fresh-water polypus, possessed of a still slower share of motion, 347—many plants propagated from the deposition of birds, iv. 248.

Platina, or white gold, the most obstinate of all substances, i. 64.

Platypus, a new and singular quadruped from New Holland, described by Dr. Shaw, iii. 271.

Pleuronectes, or flat-fish, described, v. 127.

Pliny, in his arrangements different from the present, placed the bats among birds, iii. 226.

Plover, the green and grey, are birds of passage—the Norfolk plover—season of courtship, iv. 332.

Pochard, a kind of duck, iv. 411.

Poetry, our ancestors excelled us in the poetic arts, as they had the first rifling of all the striking images of nature ii. 112.

Pointer, a kind of dog, iii. 17.

Poison, the most deadly poisons are often of great use in medicine, i. 355—fishes often live and subsist upon such substances as are poisonous to the more perfect classes of animated nature—that numbers of fishes inflict poisonous wounds, in the opinion of many, cannot be doubted—the many speculations and conjectures to which this poisonous quality in some fishes has given rise, v. 155—some crabs found poisonous, 177—the seat where the poison in venomous serpents, v. 352 the serpent poison may be taken inwardly, without any sensible effects, or any prejudice to the constitution—an instance of it—if milk be ejected into a vein, it will kill with more certain destruction than even the poison of the viper, vii. 355. See *Fireflare.*

Polar-regions, description of them, i. 8—and of the inhabitants round them, ii. 72.

Pole-cat, a distinct species from the ermine, iii. 79—resembles the ferret so much, that some have thought them the same animal—there are many distinctions between them—warreners assert the pole-cat will mix with the ferret—Mr. Buffon denies it—description of the pole-cat—very destructive to young game—the rabbit its favourite prey; and one pole-cat destroys a whole warren by a wound hardly perceptible—generally reside in woods or thick brakes, making holes two yards deep under ground—in winter, they rob the hen-roost and the dairy—particularly destructive among pigeons—and feast upon their brains—fond also of honey—female brings forth in summer five or six young at a time, and supplies the want of milk with the blood of such animals as she can seize—the fur is in less estimation than of inferior kinds, and why—an inhabitant of temperate climates, being afraid of cold as

well as heat—the species confined in Europe to a range from Poland to Italy, iii. 83, &c.—pole-cat of America and Virginia are names for the squash and the skink—distinctions of those animals, 98—seizes the flying squirrel, 146.

Poles, trade-winds continually blow from them towards the equator, i. 284—the winter beginning round the poles, the same misty appearance produced in the southern climates by heat is there produced by cold—the sea smokes like an oven there—limbs of the inhabitants of those regions sometimes frozen and drop off, 330—as we approach the north pole the size of the natives proportionably diminishes, growing less and less as we advance higher—the strength of the natives round the polar regions is not less amazing than their patience in hunger, ii. 75.

Polynemus, description of this fish, v. 125.

Polypus, very voracious—its description—uses its arms as a fisherman his net—is not of the vegetable tribe but a real animal—examined with a microscope, several little specks are seen like buds, that pullulate from different parts of the body, and these soon appear to be young polypi, beginning to cast their little arms about for prey; the same food is digested, and serves for nourishment of both—every polypus has a colony sprouting from its body; and these new ones, even while attached to the parent, become parents themselves, with a smaller colony also budding from them—though cut into thousands of parts, each still retains its vivacious quality, and shortly becomes a distinct and complete polypus, fit to reproduce upon cutting in pieces—it hunts for its food, and possesses a power of chusing it or retreating from danger, i. 363—dimensions of the sea-polypus, and of that which grows in fresh waters—the power of dissection first tried upon these animals to multiply their numbers—Mr. Trembley has the honour of the first discovery of the amazing properties and powers of this animal—this class of animals divided into four different kinds—method of conceiving a just idea of their figure—manner of lengthening or contracting itself—progressive motion—an appearance of an organ of sight found over the whole body—inclined to turn towards the light—their way of living——arms serve them as lime-twigs do a fowler—how it seizes upon its prey—testifies its hunger by opening its mouth——having seized the prey, opens its mouth, in proportion to the size of what it would swallow, whether fish, flesh, or insects—when two mouths are joined upon one common prey, the largest swallows his antagonist; but after laying in the conqueror's body for about an hour, it issues unhurt, and often in possession of the prey of contention—the cold approaching to congelation, they feel the general torpor of nature, and their faculties are for two or three months suspended—such as are best supplied, soonest acquire their largest size, but they diminish also in

their growth with the same facility, if their food be lessened—some propagated from eggs; some produced by buds issuing from the body as plants by inoculation; while all may be multiplied by cuttings to an amazing degree of minuteness—of those produced by buds issuing from the parent stem, should the parent swallow a red worm, it gives a tincture to all its fluids, and the young partakes of the parental colour; but if the latter should seize upon the same prey, the parent is no way benefited by the capture, all the advantage thus remains with the young—several young of different sizes are growing from its body; some just budding forth, others acquiring perfect form, and others ready to drop from the original stem; those young, still attached to the parent, bud and propagate also, each holding dependence upon its parent—artificial method of propagating these animals by cuttings—Mr. Hughes describes a species of this animal, but mistakes its nature, and calls it a sensitive flowering plant, vi. 183.

Polypus-coral, the work of an infinite number of reptiles of that kind, vi. 195—in every coralline substance are a number of polypi, 197.

Pongo, name given by Battel to the ouran-outang, iii. 286.

Poppies affect with drowsiness those who walk through fields of them, or are occupied in preparing the flowers for opium, i. 270.

Porcelain, an artificial composition of earth and water, united by heat, i. 140.

Porcupine, an enlarged hedge-hog—its description—of all those brought into Europe, not one ever seen to launch its quills, though sufficiently provoked—their manner of defence—directs its quills pointing to the enemy—Kolben relates, the lion then will not venture an attack—feeds on serpents and other reptiles—the porcupine and serpent are said never to meet without a mortal engagement—how it destroys and devours them—of Canada subsists on vegetables—those brought to this country for shew, usually fed on bread, milk, and fruits; do not refuse meat when offered—is extremely hurtful to gardens—the Americans, who hunt it, believe it lives from twelve to fifteen years—during the time of coupling, in the month of September, the males become fierce and dangerous, and often destroy each other with their teeth—time of gestation—the female brings forth one at a time; she suckles it about a month, and accustoms it to live like herself upon vegetables and the bark of trees—the female very fierce in the defence of her young; at other seasons, fearful, timid, and harmless—never attempts to bite or any way injure its pursuers—manner of escaping, when hunted by a dog or a wolf—the Indians pursue it to make embroidery with its quills, and eat its flesh—circumstances concerning

it remaining to be known—little known with precision, except what offers in a state of captivity—description of one kept in an iron cage—the porcupine of America differs much from that of the ancient continent—two kinds, the couandow and the urson—description of both, iii. 204.

Porcupine of the Sea, described, v. 110.

Pork, unpalatable with us in summer, is the finest eating in warmer latitudes, and preferable to hog's flesh in Europe, ii. 201.

Porpus, or *Porpesse*, a fish less than a grampus, with the snout of a hog—its description and habits—a fishery for them along the western isles of Scotland, in the summer season, when they abound on that shore—live to a considerable age, though some say not above twenty-five or thirty years—sleep with the snout above water—possess, proportionably to their bulk, the manners of whales—places where they seek for prey—destroy the nets of fishermen on the coasts of Cornwall—manner of killing them in the Thames—yield a large quantity of oil—the lean of some, not old, said to be as well tasted as veal—caviar prepared from the eggs of this fish, v. 54.

Ports choaked up with sand by the vehemence of the wind, i. 288.

Pouch, or bag, of the civet, differs in its opening from that of the rest of the weasel kind—description of it, iii. 106—of the bustard, under the tongue, capable of holding near seven quarts of water, iv. 151—of the pelican, hides as many fish as will serve sixty hungry men for a meal—its description, 353.

Poultry, general characteristics of the poultry kind—they live together; and each conscious of his strength, seldom tries a second combat, where he has been once worsted—kept in the same district, or fed in the same yard, they learn the arts of subordination—the young of the kind, not fed with meat put into their mouths, peck their food—the female intent on providing food for her young clutch, and scarce takes any nourishment at all—among the habits of this class of birds, is the peculiarity of dusting themselves—nearly all domestic birds of this kind, maintained in our yards, are of foreign extraction—the courtship of this kind is short, and the congress fortuitous—the male takes no heed of his offspring—though timorous with birds of prey, he is incredibly bold among his own kind; the sight of a male of his own species produces a combat—the female takes all the labour of hatching and bringing up her young, chusing a place remote from the cock, iv. 119, &c.

Powis Land, in Wales, for many ages famous for a swift and generous race of horses, and why, ii. 194.

Powters, a variety of the tame pigeons, iv. 231.

Pregnancy of some women found to continue a month beyond the usual time, i. 381—of all animals, in point of time, is proportioned to their size, ii. 167.

Pressure, perpendicular in rivers, always in exact proportion to the depth, i. 168.

Prey, all the males of these birds are a third less, and weaker than the females, iv. 63. See *Birds*.

Pricket, name hunters give the buck the second year, ii. 323.

Prickly-finned-fishes, their description, v. 121.

Propagation of gnats, one of the strangest discoveries in natural history, vi. 163—a new kind lately discovered in a most numerous tribe of animals, propagated by cuttings, 170—different manners of that operation in the polypi, to the astonishment of the learned of Europe, 190.

Propolis, a resinous gum, with which the bees plaster the inside of their hives, vi. 97.

Proportion of the human figure, little known with precision in regard to it—different opinions upon the subject, i. 427.

Ptarmigan, sort of grouse, chiefly found in heathy mountains, and piny forests, at a distance from mankind—size and colour, iv. 152.

Pthiriasis, the lousy disease, frequent among the ancients—principal people who died of this disorder—plants and animals are infested with diseases of this kind—a vegetable louse from America over-run all the physic-garden at Leyden—the leaf-louse described—the males have four wings, the females never have any—when they perceive the ant behind them, they kick back with their hind feet—three principal and constant enemies to these insects, v. 417.

Puffin, or *Coulterneb*, marks that distinguish this bird—its residence—migrations—found by hundreds, cast away upon shores, lean and perished with famine—lays one egg—few birds or beasts venture to attack its retreats—in what manner it defends itself against the raven—the manks puffin is itself one of the most terrible invaders—instances of it—places which abound with them—in what manner their young are fed—their food—formerly their flesh was allowed by the church on lenten days—they bite extremely hard, and keep such hold of what they seize, as not easily disengaged—their noise [illegible] taken very disagreeable, like the efforts of a dumb person [illegible]pting to speak—quantity of oil in their bodies, iv. 389.

Purre, a small bird of the crane kind, with a shorter bill, and thighs bare of feathers, iv. 332.

Puteoli, a [illegible] swallowed up by an earthquake, had a temple of Serapis; the pillars of which, while under water, were penetrated by the pholas, or file-fish, v. 252.

Putrefaction, a new cause of animal life—later discoveries have

induced many to doubt whether animal life cannot be produced merely from thence, i. 362.

Pygmy of Tyson, the ouran-outang, or the wild man of the wood, iii. 277.

Pyramids of Egypt, one of them entirely built of a kind of free-stone, in which petrified shells are found in great abundance, i. 42.

Pyrites, their composition—sulphur and iron blended and heated with air or water, will form these, and marcasites, i. 66.

Q.

Quadrupeds, of all ranks of animated nature, bear the nearest resemblance to man; are less changed by influence of climate or food than the lower ranks of nature—some are of so equivocal a nature, it is hard to tell whether they ought to be ranked in this class, or degraded to those below them—instances of it, ii. 145—the weaker races exert all efforts to avoid their invaders, 157—next to human influence, the climate seems to have the strongest effects upon their nature and form, 161—both at the line and the pole, the wild are fierce and untameable, 162—one class of these entirely left to chance, no parent stands forth to protect them, and no instructor leads, or teaches them the arts of subsistence; these bring forth above two hundred young at a time, 169—America inferior to us in these productions—opinion, that all in South America are a different species from those most resembling them in the old world—such as peculiarly belong to the new continent, are without any marks of the perfection of their species, 164—the large and formidable produce but one young at a time; while the mean and contemptible are prolific—wisely ordered so by Providence, 165—those that are amphibious have motion in the lower eye-lid alone, i. 411—those that ruminate are harmless, and easily tamed—they are chiefly the cow, the sheep, and the deer-kind, ii. 217.

Quagga, an animal resembling the zebra, but distinct from it, ii. 216.

Quail, a bird of passage—description of it—time [illegible]s migrations—opinion, that it only goes from one par[illegible]untry to another—their long journies doubtful—how ca[illegible]t by a [illegible]—number of their eggs—fight desperately at the season [illegible] courtship, and easily taken at that time, iv. 161.

Quail-fighting, a favourite amusement among the [illegible]ans—abstained from the flesh of this bird, supposing it fed up[illegible]n [illegible]hite hellebore—reared numbers of them for fighting, and [illegible]tted sums of money, as we do on cocks, iv. 163.

Quicksilver, remarkable effects of it at the mines near Idra, related by Dr. Pope, i. 68—the heaviest substance in the world, except gold—floats upon water by a particular experiment, 158—seventy-one pounds and a half equal in bulk to a hundred pound weight of gold, 159.

Quills (of the porcupine) the Indians embroider with them their belts, baskets, and several other necessary pieces of furniture—enquiry whether the quills of the porcupine can be sent off with a shake, iii. 209.

Quito, in South America, capital city of, one of the most charming regions upon earth—this part higher than any other country in the world, i. 125.

R.

Rabbits have eyes of a red colour, i. 409—rabbit and hare of distinct kinds—refuse to mix with each other—instance of it—few quadrupeds can overtake the rabbit in a short run, iii. 127—a creature covered with feathers and hair, said to be bred between a rabbit and a hen—their fecundity greater than that of the hare—breed seven times a year, and bring eight young each time—love the sunny field, and open pasture—the female suckles the young about a month—the male attends the young, leads them out, and conducts them back—have an external retreat at a distance from the warren, as a kind of country-house—female brings forth in a part of the warren separate from the male, and digs herself a hole, more intricate, at the bottom of which is a more ample apartment—some hair she pulls from her belly makes a bed for her young—the male, after six weeks, acknowledges them as his offspring, smooths their skin, and licks their eyes, iii. 127, &c.

Rabbits, (tame) in a warren, continue exposed to weather, without burrowing—in two or three generations, they find the necessity and convenience of an asylum—various colours of rabbits—the mouse-colour kinds originally from an island in the river Humber—still continuing their general colour, after a number of successive generations—account of their production—surprising obedience and submission of descendants to their [illegible] parent—the descendants quarrelling, his appearance restores peace and order—sometimes he punishes them, as an example to the rest—other instances of superiority of the common parent—the rabbit generally fatter, and lives longer than the hare—its flesh less delicate—native of the warmer climates—it has been imported into England from Spain—in some of the islands of the Mediterranean,

they multiplied in such numbers that military aid was demanded to destroy them—love a warm climate—English counties most noted for them—delight in a sandy soil—the tame larger than the wild—indulged in too great plenty of moist food, as the feeders express it, are apt to grow rotten—their hair employed in England for several purposes—the skin of the male preferred, iii. 130, &c.

Rabbit (Syrian) remarkable for the length, gloss, and softness of its hair, iii. 133—in some places curled at the end like wool, and shed once a year in large masses; and some part dragging on the ground, appears like another leg or a longer tail—no rabbits natural in America—those carried from Europe multiply in the West-India islands abundantly—on the continent there are animals resembling the European rabbits, 134.

Rabbit (Brasilian) shaped like the English, but without a tail—does not burrow like ours, and is not above twice the size of a dormouse—Guinea-pig placed by Brisson among animals of the rabbit kind, iii. 160.

Racoon, with some the Jamaica-rat—its description, and habits—do more injury in one night in Jamaica, than the labours of a month can repair—capable of being instructed in amusing tricks; drinks by lapping, as well as by sucking—its food, iii. 394.

Rainbows, circular rainbows in the Alps, i. 121—and between the tropics, and near the poles, 324—one of the three rainbows seen by Ulloa, at Quito, was real, the rest only reflections thereof—a glass globe, filled with water, will assume successively all the colours of the rainbow—upon the tops of very high mountains, circular rainbows are seen, and why—a lunar rainbow, near the poles, appears of a pale white, striped with grey—the solar rainbow, in Greenland, appears of a pale white, edged with a stripe of dusky yellow, i. 328.

Rain-fowl, the name given in some parts of the country to the wood-pecker, and why, iv. 191.

Rains of blood, the excrements of an insect at that time raised into the air, i. 333.

Rams, it is no uncommon thing in the counties of Lincoln and Warwick, to give fifty guineas for a ram, ii. 254.

Ranguer, the name of the ninth variety of gazelles, marked by Mr. Buffon, ii. 283.

Rarefaction of air, produced by the heat of the sun-beams in countries under the line, being flat and sandy, low and extensive, as the deserts of Africa, i. 285.

Rats, *Musk-rat*, three distinctions of that species—the *ondatra*, *desman*, and *pilori*—the ondatra differs from all others, having the tail flatted and carried edge-ways—in what they resemble each other—female of the ondatra has two apertures, one for

urine, the other for propagation—they can creep into a hole, where others, seemingly much less, cannot follow, and why—they resemble the beaver in nature and disposition—manner of life—their houses during winter are covered under a depth of eight or ten feet of snow—the savages of Canada think the musk-rat intolerably fœtid, but deem its flesh good eating, iii. 179—*great rat*, called also *rat of Norway*, though unknown in all northern countries—originally from the Levant, and a new comer into this country—first arrival upon the coasts of Ireland, with ships trading in provisions to Gibraltar—a single pair enough for the numerous progeny now infesting the British empire—called by Mr. Buffon the *surmalot*—its description—the Norway rat has destroyed the *black rat* or *common rat*, as once called; and, being of an amphibious nature, has also destroyed the frogs in Ireland—great mischief done by the Norway rat—it swims with ease, dives with celerity, and soon thins the fish-pond—the feebler animals do not escape the rapacity of the Norway-rat, except the mouse—they eat and destroy each other—the large male keeps in a hole by itself, and dreaded by its own species, as a most formidable enemy—produce from fifteen to thirty at a time; and bring forth three times a year—quadrupeds which have antipathies against the rat—the *black rat* has propagated in America in great numbers, introduced from Europe, and are become the most noxious animal there—its description *black water-rat*, not web-footed as supposed by Ray—its description—its food—is eat, in some countries, on fasting days—the nux-vomica, ground and mixed with meal, the most certain poison, and the least dangerous to kill rats, iii. 167.

Rat of Surinam. See *Phalanger*, iii. 237.

Rat of Jamaica, a name by some given to the racoon, iii. 394.

Rattle-snake, its description, and dimensions—effects of its bite—the remedies against it—power of charming its prey into its mouth—facts related to this purpose, v. 363—kind of friendship between it and the armadilla, or tatou, frequently found in the same hole, iii. 224.

Ravens, how distinguished from the *carrion-crow* and *rook*—manners and appetites—raven found in every region of the world—white ravens often shewn, and rendered so by art—trained up for fowling like a hawk; taught tu fetch and carry like a spaniel—to speak like a parrot; and to sing like a man, with distinctness, truth, and humour——amusing qualities, vices, and defects—food in the wild state—places for building nests—number of eggs—will not permit their young to keep in the same district, but drive them off when sufficiently able to shift for themselves—three of the Western Islands occupied by a pair of ravens each, that drive off all other birds with

great cries and impetuosity—pick out the eyes of sheep and lambs when sick and helpless—the Romans thought it ominous, and from fear paid it profound veneration—Pliny's account of one kept in the temple of Castor, and flew down into the shop of a taylor—some have lived near a hundred years—in clear weather they fly in pairs to a great height, making a deep loud noise, different from their usual croaking, iv. 172—the horned Indian raven, 182.

Ray, (Mr.) his method of classing animals, ii. 134.

Ray, figure of the fish of this kind, and their differences—amazing dimensions of one speared by negroes at Gaudaloupe—to credit the Norway bishop, there are some above a mile over—supposed to be the largest inhabitants of the deep—chuses its retreat in such parts of the sea as have a black muddy bottom—the small approach the shores—their food—they generate in March and April, when they swim near the surface of the water, several males pursuing one female—adhere so fast in coition, that the fishermen frequently draw up both together, though only one was hooked—three hundred eggs taken out of the body of a ray—in what manner the eggs drop into the womb from the ovary, or egg-bag—breeding ceases in October, and in May are in highest perfection—account of the method of taking them, v. 75—all extremely delicate in their choice of baits; a piece of herring or haddock twelve hours out of the sea, and then used as a bait, they will not touch—best weather for taking them—method used by the Italians in the Mediterranean to take this fish—they bait a line of twenty miles long, with ten or twelve thousand hooks—no way of seizing the rough ray, but by the little fin at the end of the tail, 82.

Rays of light moderated, and their violence dissipated by the air, i. 277.

Rays of the sun, darted directly upon the surface of the water, compared to so many bars of red-hot iron, i. 315.

Razor-fish, the *coryphæna* of the prickly-finned thoracic kind—its description, v. 123.

Razor-shell, the *pivot*, its motion and habits—is allured by salt, v. 241.

Red-breast, a song-bird, seemingly mild; claims a district, whence it seldom moves, but drives away every one of the same species without pity, iv. 23—its voice has the delicacy of the flute—places where found—its nest, and the number of eggs, 260.

Red-shank, a kind of crane, iv. 332.

Red-start, bird of the sparrow-kind, iv. 247.

Red-wing, or *Field-fare*, bird of passage—its nest and eggs, iv. 253.

Reed, stuck into the ground in Persia, where the earth is impreg-

nated with inflammable vapours, continues to burn like a flambeau, i. 74.

Reeve, name given to the female of the *ruff*, iv. 340.

Rein-deer, killed by eight Englishmen upon the coast of Greenland, for their subsistence, remained sweet eight months, without any salt whatever, i. 259. For the description of this animal see *Deer*, ii. 340.

Relievo, painters can never fully imitate that bold relievo, which both eyes give to the object, ii. 23.

Remora, the *sucking-fish*, it sticks to the shark, and drains away its moisture; the seamen believe it attends the shark to point out prey; and apprize him of danger; for this reason it is called the *Shark's pilot*, v. 74.

Reproduction, the first discovery of the power of reproduction in animals owing to Mr. Trembley—experiments made to this purpose, vi. 177.

Reptiles, grow to a prodigious size in the internal parts of South America and Africa, and why, ii. 5—many of the more humble kinds not only confined to one country, but to a plant; nay, even to a leaf—entirely assimilated to the plant they feed on; assume its colour, and medicinal properties—taken from that, they instantly die—infinite numbers of them not seen in this part of the world, and why, i. 350.

Respiration in fishes, general method of explaining it, v. 16—particularly in that of the whale-kind, 28.

Rhinoceros, a ruminating animal, ii. 220—not afraid singly to oppose the lion, 402—next to the elephant the most powerful of animals—general out-line of it—the elephant defeated by it—its horn sometimes found from three to three feet and a half long—this horn composed of the most solid substance, and pointed so as to inflict the most fatal wounds—fabulous reports of this animal—description of its tongue by L'Avocat—a rhinoceros sent from Bengal to London, not above two years old, cost near a thousand pounds for his conveyance and food—how it was fed—of a gentle disposition, permitted itself to be touched and handled by all visitors, attempting no mischief but when abused, or hungry; no method of appeasing its fury then but by giving it something to eat—when angry, it jumped against the walls of the room with great violence—its age—its food—places where found—in some parts of Asia these animals are tamed, and led into the field to strike terror into the enemy, but are as dangerous to the employers—method of taking them—some found in Africa with a double horn, one above the other—many medicinal virtues ascribed to this horn when taken in powder, without any foundation, iii. 357, &c.

Rivers, all our greatest find their source among mountains, i. [illegible]—make their own beds, and level the bottom of their channels—rivers dig and widen themselves to a certain degree

—their banks appear above water, after inundations, when the adjacent valley is overflown, and why—their sinuosities and turnings more numerous as they proceed—a certain sign with the savages of North America, they are near the sea, when they find the rivers winding and often changing their direction—rivers rise in the middle, and the convexity is in proportion to the rapidity of the stream—when tides flow up with violence against the natural current, the greatest rapidity is then found at the sides of the river, and why—at these times, the middle waters sink in a furrow—a little river received into a large, without augmenting either width or depth, and why—instance of it—a river tending to enter another either perpendicularly or in an opposite direction, will be diverted by degrees from that direction, and obliged to make itself a more favourable entrance with the stream of the former—the union of two rivers into one makes a swifter flow, and why—whatever direction the ridge of the mountain has, the river takes the opposite course, i. 169—their branches compared to a number of roots conveying nourishment to stately trees—equally difficult to tell which the original—every great river, whose source lies within the tropics, has its stated inundations—those of countries least inhabited are very rocky and broken into cataracts, and why, 182—some lose themselves in the sands or are swallowed up by chasms in the earth—at the poles necessarily small, and why—the rivers of Europe more navigable and more manageable than those of Africa and the torrid zone, 188—all rivers in the world flowing into the sea with a continuance of their present stores, would take up, at a rude computation, eight hundred years to fill it to its present height, 191.

Robin-red-breast, a slender-billed bird of the sparrow-kind, living upon insects, iv. 247.

Rock, great bird, described by Arabian writers, and exaggerated by fable, supposed to be but a species of the condor, between the eagle and vulture, iv. 80.

Roe-buck, the smallest of the deer-kind in our climate—its description—differs from the fallow-deer, from the stag, and from all the goat-kind—faces the stag, and often comes off victorious—those bucks live in separate families; the sire, dam, and young, associate, and admit no stranger into their community—never leaves its mate—rutting season continues but fifteen days, from the end of October to the middle of November—female goes with young five months and a half—produces two at a time, and three rarely—her tenderness in protecting them very extraordinary—names given by hunters to the different kinds and ages of it—time of shedding its horns—its life seldom longer than twelve or fifteen years, and tame not above six or seven—is of a delicate constitution—easily subdued, but never thoroughly tamed—its cry neither so loud

nor so frequent as the stag's—hunters easily imitate the call of the young to the dam, and thus allure her to destruction—this animal contented to slake its thirst with the dew on the grass and leaves of trees—prefers tender branches and buds of trees to corn and other vegetables—we have but two known varieties—the flesh of those between one and two years old the greatest delicacy known—more common in America than in Europe—inhabitants of Louisiana live upon its flesh, which tastes like mutton when well fatted—the breed extremely numerous, and the varieties in proportion—found also in Brasil, where called cuguacuapara; and in China—its describers there confound it with the musk-goat, though of a different nature, ii. 326.

Roller, a beautiful bird of the pie-kind, its description, iv. 187.

Romans cut down all the woods and forests in Britain, and why, i. 237—in battle, opened their ranks to admit the elephant, and separating it from assistance compelled its conductors to calm its fury and submit, iii. 352—the vanity of their boasts best shewn by the parrot-kind, in a hundred species now known, not one of those birds naturally breeds in any of the countries that acknowledged the Roman power, iv. 223—a Roman Emperor had fifteen hundred flamingo's tongues served up in a single dish at a feast, 326—a Roman senator used to throw into his ponds such of his slaves as offended him, to feed the lampreys, v. 97—infamous for a Roman to appear in a dress in which silk entered into the composition, vi. 80.

Rooks, of the pie-kind, not carnivorous—places where they build their nests—their plan of policy—young couples making nests too near an old pair, a battle ensues, and the old become victorious—fatigues of the young in making nests—the female beginning to lay, all hostilities cease, and she is suffered to hatch her brood without molestation—a foreign rook attempting to join society with them, would have the grove in arms against him, and be expelled without mercy—their chief food—foreign rooks, iv. 177.

Roses, otter of roses, a modern delicate perfume, iii. 108.

Rousette, the great bat of Madagascar, a formidable creature, described—drinks the juice of the palm-tree, iii. 232.

Royston-crow, a bird of passage, described, iv. 177.

Rubeth, the land-toad, the only one of the kind that has the property of sucking cancerous breasts, v. 283.

Ruff, a small bird of the crane-kind—manner of taking it—their flesh in high estimation, iv. 340.

Ruminant animals most harmless and easily tamed—generally go in herds for mutual security—live entirely upon vegetables—the meanest of them unite in each other's defence—are more indolent and less artful than the carnivorous kinds, and why—nature has enlarged the capacity of their intestines for a greater supply of food, ii. 217—their bowels considered as an

elaboratory with vessels in it—made their intestines strong, fleshy, and well covered with fat—and furnished them with four strong and muscular stomachs—some that are not furnished with four stomachs—ruminant quadrupeds, birds, fishes, insects, 218—men known to ruminate; instance in a young man at Bristol, 221—those of the cow-kind hold the first rank, 222—all of this class internally much alike, 247—have not the upper fore-teeth, 254—the stag performs this with more difficulty than the cow or sheep, 305.

Runner, the corrira, bird of the crane-kind, its description, iv. 329.

Runts, a variety of tame pigeons, produced by cross-coupling, iv. 231.

Rust, copper and iron quickly covered and corroded with it—gold contracts no rust, and why, except in the elaboratories where salt is much used, i. 258.

S.

Sable, its description, from Mr. Jonelin, the first accurate observer of this animal—sables leap with ease from tree to tree, and are afraid of the sun—different colours of their fur—hunting the sable chiefly the lot of soldiers and condemned criminals—how directed to shoot them, iii. 91, &c.

Sabre, the trachepterus, description of this spinous fish, v. 125.

Sacre, bird of the generous breed of hawks, the legs are of a blueish colour, and serve to distinguish it, iv. 92.

Sago-tree eat by the elephant to the stump, iii. 338.

Sagoin, a tribe of monkies which have feeble useless tails, iii. 314.

Sai, the bewailer, a monkey of the new continent, iii. 315.

Sail, a stag hard hunted, taking to the water, is said to go sail, ii. 312.

Sajou, third sort of the sapajou, a monkey of the new continent, iii. 315.

Saki, the cagui, the largest monkey of the sagoin kind—its description, iii. 316.

Salamander, no such animal existing as that described by the ancients—the modern salamander a lizard—its conformation and habits—reports concerning their venom—idle notion of its being inconsumable by fire—its internal conformation—manner of its bringing forth young—all amphibious—sustain want of food surprisingly, v. 309.

Sal-ammoniac, made of the urine of camels, iii. 378.

Salmon, a soft-finned abdominal fish, v. 128—the young continue in the egg from the beginning of December till the begining of April, 23.

Salt-water, opinions about the saltness of the sea, particularly that of Boyle—method of finding out the age of the world by the saltness of the ocean—saltness found to prevail in every part of the ocean, as much at the surface as at the bottom—also found in some lakes—considered as a principal cause in preserving the sea from putrefaction—it is confirmed by experiments—advantages derived from the saltness of the sea—various attempts to make it fresh—its weight, i. 196.
Salt, Bay-salt, brought from the Bay of Biscay, a strong kind made by evaporation in the sun, i. 201—fishes do not imbibe any of the saltness of the sea-water, v. 134—allures the pivot, or razor-shell, 241—salt sprinkled upon the water-lizard, the whole body emits a viscous liquor, and it dies in three minutes, in great agonies, 315—volatile caustic salt obtained in great quantity from the cantharides fly, vi. 153.
Samiri, the aurora, the smallest and most beautiful monkey of the sapajou kind—its description—a very delicate animal, and held in high price, iii. 316.
Samoeid Tartars, description of that people, ii. 72.
Sand, rolling in waves like a troubled sea, and overwhelming all with inevitable destruction, i. 10—so fine, and driven with such violence, as to penetrate into chests, be they ſhut never so closely, 295—tract of a country, lying along the sea-side in Lower Britanny, inhabited before the year 1666, now lies desert, being covered with sand to the height of twenty feet, 301.
Sanderling, small bird of the crane kind, iv. 332.
Sandpiper, small bird of the crane kind, iv. 332.
Sand-storm of Africa described, i. 300.
Sand-wasp, account of, vi. 126.
Santorin, an earthquake there in 1707—a new volcano near it, i. 105.
Sapajou, name given to the monkies of the new continent, that have muscular holding tails—five sorts of them, iii. 314.
Savages more difficult in point of dress than the fashionable or tawdry European—instance of it, i. 420—perform a journey of twelve hundred leagues in less than six weeks, 433—oblige the women to a life of continual labour—are surprised a European walks backward and forward for his amusement, 438—the boast of corporal force now resigned to savage nations, and why, 437—are highly delighted with the smell of assafœtida, ii. 48—their customs in every country almost the ſame, 85—those of Africa the most brutal—they, and thoſe of America, suppose monkies to be men, idle, slothful, rational beings, capable of speech and conversation, but obstinately dumb, for fear of being compelled to labour, iii. 311.
Savours, mechanical manner of accounting for difference of savours, ii. 49.

Scallop, in its shell, moves forward upon land, and swims upon the surface of the water, in a singular manner, v. 239, 240.

Scaup Duck, a variety of the duck kind, iv. 411.

Sciæna, a spinous fish—description, v. 124.

Scolopendra, the centipedes, a hideous angry worm, described, v. 437.

Scomber, the mackarel, a prickly-finned thoracic fish—its description, v. 123.

Scooper. See *Avosetta*, iv. 329.

Scorpæna, or father-lasher, of the prickly-finned thoracic kind—description of this fish, v. 124.

Scorpion, four principal parts distinguishable in this animal—the reservoir where its poison is kept—effects of its sting upon a dog, in an experiment made by M. Maupertuis—experiments made upon other dogs—instances of its irascible nature and malignity—when driven to extremity, destroys itself—instance of it—the male smaller than the female—their chief food—how the common scorpion produces its young—captivity makes it destroy its young—a scorpion of America produced from the egg, v. 429.

Scorpion, (water) an insect with wings, described—its habits, vi. 35.

Scoter, an European duck, iv. 411.

Screech-owl described, iv. 109.

Sea, motion keeps its water sweet, i. 201—open to all nations till the time of the emperor Justinian, i. 194—sensibly retired in many parts of the coasts of France, England, Holland, Germany, and Prussia, 229—Norwegian sea has formed several islands from the main land, and still advances upon the continent, 232—its colour not from any thing floating in it, but from the different reflexions of the rays of light—a proof of it—though its surface be deformed by tempests, it is usually calm and temperate below—the sea grows colder in proportion as divers descend, 242—smokes like an oven near the poles, when the winter begins, 330—no fish imbibe any of the sea-saltness with food or in respiration—why some species live only there, and expire when brought into fresh water, v. 134.

Sea-bream, an account of, i. 207, v. 124.

Sea-eggs, name given to the multivalve shell-fish—of the echini, or urchins, which move, v. 248.

Sea-lion described, iii. 265.

Sea-nettles, name given by some to the star-fish, vi. 183.

Sea-water, various methods proposed to render it fresh for the use of seamen in long voyages, i. 199—about a forty-fifth part heavier than fresh water—is heavier, and consequently salter, the nearer we approach the line, 202. See *Salt-water*.

Sea-worm may be multiplied by being cut in pieces, i. 363. See *Polypus*.

Seal, resembles both a quadruped in some respects, and a fish in others—its description—the varieties innumerable—the brain largest of any animal—its tongue differs from other quadrupeds—the foramen ovale in its heart never closing, fits it for continuing under water, though not so long as fishes—the water its habitation, and any fish its food—makes little use of its legs—seldom at a distance from the shore—found in the North and Icy Seas, and on those shores in flocks, basking on the rocks, and suckling their young—alarmed, they plunge all together into the water—in thunder and torrents they sport along the shore, as delighted with universal disorder—gregarious and migrant, direct their course to northern coasts and seas free of ice, observing time and track—how and by what passages they return unknown—they go out fat and return lean—females in our climate bring forth in winter—where they rear their young, iii. 255—how they suckle them—ſhe has four teats—in fifteen days, ſhe brings the young to the water, to swim and get food—no litter exceeds four—the young know the mother's voice among the bleatings of the old—assist each other in danger, and are obedient to her call—hunt and herd together, and have a variety of tones like dogs and cats, to pursue prey, or warn of danger—feeling natural desires, they fight desperately, and the victorious male keeps all to himself—two never fall upon one, each has its antagonist—neither length of time in pregnancy, nor duration of these animals lives, yet known—two taken young, after ten years had the marks of age—expert at catching fish—destroy herrings by thousands—swift in deep waters, and dive with rapidity—attacked with stones, they bite at what is thrown, and to the last gasp annoy the enemy—time to surprise them—how the Europeans and Greenlanders destroy them—in our climate they are wary, and suffer no approach—never sleep without moving, and seldom more than a minute—taken for their skin and oil—uses of the skin when dressed—the flesh formerly at the tables of the great—an instance of it—the sea-lion, in Anson's Voyage, the largest of the seal family, 204.

Secretary-bird, devours serpents, iv. 99.

Seeds, some thought to thrive better for maceration in the stomach of birds, before they be voided on the ground, iv. 248.

Sensations, their illusion when man is newly brought into existence, ii. 52—fish fall behind terrestrial animals in their sensations, v. 6.

Senses, acting at some distance, proportionably more capable of making combinations; and, consequently, more improveable, ii. 45—of all senses man is most inferior to that of other animals in that of smelling—and it seems not to offend them, 46—the grossest, and most useful of all, is that of feeling, 50.

Sensitive-plant, has as much perception as the fresh water polypus, i. 347.

Seps, improper name of the Chalcidian lizard, the last division of that kind—description of this animal, v. 323—its bite very venomous, 370.

Serpents, the sea about the islands of Azores replenished with them for want of motion, i. 200—the various hissings at the close of evening, make a louder symphony in Africa than birds in European groves in a morning, ii. 155.—the natural food of the ichneumon, iii. 97—the only animal in the forest that opposes the monkey—surprising them sleeping, swallows them whole, before they have time for defence—monkies inhabit the tops of trees, and serpents cling to branches toward the bottom; thus near each other, as enemies in the same field of battle—this vicinity thought to argue a friendship—monkies provoke the serpents by jumping over them, iii. 302—sea-serpent, the elops described, v. 126—histories of antiquity exhibit a nation sinking under the ravages of a serpent, v. 328—Regulus leading his army along the banks of the river Bagrada, in Africa, an enormous serpent disputed the passage, its skin was an hundred and twenty feet long—marks distinguishing them from the rest of animals—their conformation—and progressive motion—encounter of a great serpent with a buffalo—entwines and devours the buffalo—long serpent of Congo—some bring their young alive, some bring forth eggs—some venomous, and some inoffensive—animals which destroy them—boasted pretensions of charming serpents—have docility—Egyptians paid adoration to a serpent; and inhabitants of the western coast of Africa retain the same veneration—all amphibious—their motion in swimming—excrements of some kept as a perfume in India—the Esculapian serpent—little serpent at the Cape of Good Hope, and north of the river Senegal—the prince of serpents a native of Japan, the greatest favourite of savages, and has not its equal for beauty—seat of poison in venomous serpents; instrument by which the wound is made—those destitute of fangs are harmless—various appearances the venom produce—may be taken inwardly without sensible effects or prejudice to the constitution—instance of it—of the force of serpents poison, by Ray—no animals bear abstinence so long—their powers of digestion but feeble—their principal food birds, moles, toads, lizards—little serpents live for several years in glasses, never eat at all, nor stain the glass with excrements, v. 325, &c.

Serval, a native of Malabar, resembling the panther in its spots, ii. 436.

Setter, a dog of the generous kind, iii. 13, 16.

Severn, lamprey of this river the most delicate of all fish, v. 94.

Shagreen, made of the skin of the wild ass, ii. 200—the skin of the ſhark, by great labour, polished into the substance called shagreen, v. 75.

Shammoy, a kind of goat, in the mountainous parts of Germany, &c.—its description—keep in flocks from four to an hundred —time of coupling—live twenty or thirty years—their flesh good to eat; the suet ten or twelve pounds—this animal has a feeble bleat, to call its young; in case of danger its hissing noise is heard at a great distance—by smell, discovers a man at half a league—feeds upon the best herbage, and delicate parts of plants, and aromatic herbs—admired for the beauty of its eyes—not found in summer, except in caverns of rocks, amidst fragments of ice, or under shades of spreading trees—in winter, it sleeps in the thicker forests, and feeds upon shrubs and buds of pine-trees, and scratches up the snow for herbage—manner of hunting it—dogs useless in the chace—skin of the shammoy, when tanned, liked for softness and warmth; the leather now called shammoy, made from the tame goat, sheep, and deer—medicinal virtues said to reside in the blood, fat, gall, and the concretion found in the stomach, and called the *German bezoar*, ii. 269.

Shank, the *Red*, and the *Green Shank*, varieties of the crane kind —their dimensions, iv. 332.

Shark, description of the great white shark—the mouth enormously wide; capable of swallowing a man—great number of teeth, v. 68—no fish swims so fast—outstrips the swiftest ships—obliged to turn on one side (not on the back) to seize the prey—instances of frightful rapacity in this fish—its enmity to man; many negroes are seized and devoured by them —loves the black men's flesh better than the white—usual method of sailors to take them—no animal harder to kill; when cut in pieces, the muscles preserve motion, and vibrate when separated from the body—how killed by the African negroes—the remora, or sucking-fish, sticks to it; for what purpose—for resemblance to the whale ranked among cetaceous fishes—brings forth living young—Rondeletius says, the female of the blue shark lets her brood, when in danger, swim down her throat, and shelter in her belly—in Mr. Pennant's opinion, the female larger than the male, 69, &c.

Sheat-fiſh, the silurus of the prickly-finned abdominal kind—its description, v. 125.

Sheep, their eyes of a water-colour, i. 409—the author saw one that would eat flesh, ii. 160—proper care taken of the animal produces favourable alterations in the fleeces, 162—in the domestic state, stupid, defenceless, and inoffensive—made so by human art alone—its description—those living upon fertile pasture, growing fat, become feeble—those without horns more dull and heavy—those with longest and finest fleeces most subject to disorders—the goat, resembling them, much

their superior—they propagate together, as of one family—distinguished from deer; these annually shedding the horns, while the permanence in the former, draws an exact line between their kinds—do not appear to have been bred in early times in Britain—no country produces such sheep as England, larger fleeces, or better for cloathing—sheep without horns the best sort, and why—in its noblest state in the African desert, or the extensive plains of Siberia—in the savage state—the woolly sheep is only in Europe, and in the temperate provinces of Asia—transported into warmer countries, loses the wool and fertility, and the flesh its flavour—subsists in cold countries, but not a natural inhabitant of them—the *Iceland sheep* have four, and sometimes eight horns—its wool inferior to the common sheep—with broad tails, and weigh from twenty to thirty pounds, and sometimes supported—those called *strepsicheros*, a native of the Archipelago—*Guinea-sheep* described, ii. 246—they eat three hundred and eighty-seven plants, and reject a hundred and forty-one, 362—have eight teeth in the lower jaw—are shed and replaced at different periods—some breeds in England never change teeth, and are supposed old a year or two before the rest, 254—bring forth one or two at a time, sometimes three or four; the third lamb supposed the best—bear their young five months—the intestines thirty times the length of their body, 389—in Syria and Persia, remarkable for fine gloss, length, and softness of hair, 391. See *Moufflon*.

Sheldrake, a variety of the pond-duck, supposed a native of England, iv. 411.

Shells, (fossil) found in all places near to and distant from the sea, upon the surface of the earth, on the tops of mountains, or at different depths, digging for marble, chalk, or other terrestrial matters, so compact as to preserve these shells from decay, i. 13—long considered as mere productions of the earth, never inhabited by fish—some have not their fellows in the ocean—but all have the properties of animal, not of mineral nature; their weight the same with those upon shore, answer all chemical trials as sea-shells do—and have the same effects in medicinal uses—various kinds found a hundred miles from the sea—a continued bed of oyster-shells found on five or six acres of ground near Reading, in Berkshire—shells found petrified in all the Alpine rocks, in the Pyrenees—on the hills of France, England, and Flanders—a floor, or pavement, of petrified shells found in Kent—shells always remaining in the deep—easier to believe fossil shells bred in fresh water, than that the sea for a time covered the tops of high mountains—petrified shells found in one of the pyramids of Egypt, i. 36—volumes upon the subject of shells contribute little to the history of shell-fish—an idea of the formation of sea-shells and garden-shells—way of accounting for different colouring in shells—

hint about the operation of nature in colouring shells—they assume every colour but blue—the animal not solely the agent in giving beauty and colouring to it—*stairs-shell*, or *admiral-shell*, not more precious for their scarceness, than pearls for their beauty—collections of shells have their use—naturally classed by Aristotle—places where shells are found—and substances of which they are composed—supposition that all earths, fermenting with vinegar, are composed of shells, crumbled down to one mass—what shells most valuable—sea-shells exceed land or fossil shells in beauty—some living land shells not inferior in beauty to fresh water shells, v. 201—great variety of fossil, or extraneous shells—different states of preservation—every shell the spoil of some animal—no matter how parted from the sea—Swammerdam's attention to testaceous animals almost beyond credibility, 211.

Shells, of the sea, scarce one met with entire and sound, and why—of all sea-shells, the nautilus, the thinnest and most easily pierced, v. 227—all bivalved shells furnish pearls, their insides resemble and afford mother-of-pearl, 242—some pierced by worms argue them food for such animals, 212.

Shells, animal, of the armadilla or tatou, one of the most striking curiosities in natural history, iii. 219—turtle-shells of an amazing magnitude, v. 194.

Shepherd's dog, considered as the primitive stock from whence all the varieties of the dog are derived, iii. 11.

Shores, of all those in the world, not one so high as that of the west of St. Kilda, six hundred fathom perpendicular above the surface of the sea, i. 227—some on which the sea has made temporary depredations, 232.

Short-heads, name given by sailors to the young of the whale, whilst at the breast, v. 38.

Shoveller, species of the crane kind—its food—inhabitants of the Cape of Good Hope respect it as the ancient Egyptians did their bird ibis—its nest and eggs, iv. 319.

Shoulders, high in sickly persons—people dying, are seen with their shoulders drawn up in a surprising manner—women with child usually seen high-shouldered, i. 425—in women, narrower than in men, 428.

Showers, dreadful shower of hail in 1510—its description, i. 322—of stones, fishes, and ivy-berries, raised into the air by tempests in one country, and falling at a distance like rain, to astonish another, 323.

Shrew mouse, described, iii. 176.

Siberia, enormous tusks found lodged in the sandy banks of the rivers in this waste country, iii. 356.

Sighs, in what manner produced—when invigorated produce sobbing, i. 416.

Sight, of old men indistinct for bodies close to them, but more precise for objects at a distance, and why, ii. 29—of birds ex-

ceeds that of other animals—a kite, from an imperceptible height, sees its prey, and darts on it with unerring aim, iv. 8—of birds that prey by day, astonishingly quick; and in such as ravage by night, so fitted as to discern objects with precision, 60.

Signs of death, uncertainty of them ought to make every one cautious of a premature interment, ii. 69.

Silk (manufactures) established in Europe, in the beginning of the twelfth century, by Roger of Sicily, vi. 80.

Silks, brought to Jamaica, and there exposed to the air, rot while they preserve their colour, but kept from air retain their strength and gloss, i. 259—anciently so scarce in Rome as to be sold for their weight in gold; considered such a luxurious refinement in dress, that infamy was attached to wearing stuffs in which it made but half the composition, vi. 80.

Silk-worm, its real history unknown among the Romans to the time of Justinian; supposed only brought into Europe in the twelfth century—two methods of breeding them—Pausanias's description of this worm—changes of its skin in three weeks or a month—gummy fluid forming the threads—preparations made before spinning the web—the cone or ball of silk described—efforts to burst the cone—free from confinement, it neither flies nor eats; the male seeks the female, impregnates her in an uninterrupted union of four days, then dies upon separation, she survives till she has laid her eggs, which are hatched into worms the ensuing spring—few of these animals suffered to come to a state of maturity, and why—the most serviceable of all such creatures, vi. 79.

Silurus, the sheat fish of the prickly-finned abdominal kind, its description, v. 125.

Sinews, of the rein-deer, the strongest kind of sewing thread, ii. 354.

Single, name of the tail of the stag, ii. 311.

Siskin, singing bird of the sparrow-kind, iv. 247—time of its migration, 249.

Size of men varies considerably—the human body often differs from itself—the same person taller when he rises in the morning, than going to bed at night; sometimes the difference is an inch; this first perceived in England by a recruiting officer—in what manner—the cause of it—men are tall from five feet eight-inches to six feet high—middle size from five feet five to five feet eight, i. 428—Maximin, the emperor, above nine feet in height, 436—approaching towards the north pole, the natives diminish proportionably, growing less and less in higher latitudes, ii. 75—cause of their difference—an ox, on the fertile plains of India, grows four times as large as the lesser animal of the same kind in the Alps, 91—of men in all ages, nearly the same as at present—many corroborating proofs of this, 112.

Skate or *Ray-fish*, described, v. 77.

Skeleton of the bat in some measure resembles that of man, iii. 226—some human lately discovered of enormous size, five or six feet beneath the surface, on the banks of the Ohio, not far from the river Miume, in America, 356.

Skin, the only part of the body that age does not harden—whence its wrinkles proceed, ii. 60—of the black fox most esteemed, a single skin selling for forty or fifty crowns—the hair is so disposed, that it is impossible to tell which way the grain lies, iii. 51—most valuable part of the martin's skin—twelve thousand of these annually imported into England from Hudson's bay, and thirty thousand from Canada—most worth when taken in the beginning of winter—of all, that of the sable most covered, and held in highest esteem—a single skin four inches broad, is often sold for ten or fifteen pounds—the fur surpassing all other in having no grain; whatever way rubbed, is equally smooth and unresisting—a certain number of these furnished every year by condemned exiles, and Russian soldiers, sent into Siberia to kill the animal, 91—of the elephant, not covered with hair—that part covering the head resembles the bark of an old tree more than the skin of an animal, 343—of the rhinoceros, so thick as to turn the edge of a scymetar, and resist a musquet-ball—is naked, rough, knotty, and lying upon the body in folds, after a very peculiar manner, 358—of the civet, so strongly scented, a person shut up with one in a close room cannot support the perfume, 107.

Skink, an animal, called one of the pole-cats of America—the author thinks it Catesby's Virginia pole-cat—its description, iii. 98.

Skull-fish, name of the whale above two years old, v. 38.

Sleep, with some lower animals, takes up the greatest part of their lives—man the only creature requiring sleep from double motives, for the refreshment of the mental, and of the bodily frame—want of it produces madness—procured to man with more difficulty than to other animals—in what manner sleep favours us for hours together, according to Rohault—care required to regulate its quantity, and why—bodily labour demands a less quantity of it than mental—the famous Philip Barettier slept twelve hours in the twenty-four—sleep to some an agreeable period of existence—questions treated in the schools on this purpose—numberless instances of persons who, asleep, performed many ordinary duties of their calling; and, with [illegible] industry, completed by night, what they failed doing by day—remarkable instance related in the German Ephemerides. See *A[illegible]to*, ii. 10.

Slot, term for the print of the hoof of the stag—to draw on the slot, a phrase among hunters, ii. 311, 312.

Sloth, different kinds of that animal, described—seem the meanest

and most ill-formed of all animals that chew the cud—their food—formed by nature to climb—they get up a tree with pain, but utterly unable to descend—drop from the branches to the ground—move with imperceptible slowness, baiting by the way—strip a tree of its verdure in less than a fortnight, afterwards devour the bark, and in a short time kill what might prove their support—every step taken, send forth a plaintive melancholy cry, which, from some resemblance to the human voice, excites a displeasing pity—like birds, have but one vent for propagation, excrement, and urine—they continue to live some time after their nobler parts are wounded, or taken away—their note, according to Kircher, an ascending and descending hexachord, uttered only by night—their look piteous, to move compassion; accompanied with tears, that dissuade injuring so wretched a being—one fastened by its feet to a pole, suspended across two beams, remained forty days without meat, drink, or sleep—an amazing instance of strength in the feet instanced, iii. 402, &c.

Slow, name given by some to the blind-worm, v. 376.

Smelling, the sense in which man is most inferior to other animals—it never offends them—stronger in nations abstaining from animal food, than in Europeans—Bramins of India have a power of smelling, equal to what is in other creatures—can smell water they drink, to us quite inodorous—in a state of nature useful, not in our situation—gives often false intelligence—natives of different countries, or different natives of the same, differ widely in that sense—instances of it—mixtures of bodies void of odour produce powerful smells—mixtures of bodies separately disagreeable, give pleasant aromatic smells—a slight cold blunts all smelling—incurable aversions to smells formerly agreeable, ret[illegible]ed from disorders—smallest changes in man make great alterations in this sense—antipathies to animals, whose presence [illegible] perceived by the smell, ii. 46—delicacy of smelling in birds [illegible]tanced in ducks, iv. 9.

Smile, Fielding asserts, a person with a steady glav[illegible] mile, never failed to prove himself a rogue, i. 4[illegible]8.

Snail, shell of the garden-snail, in what manner form[illegible] v. 202.

Snail, (sea) a cartilaginous fish, described, v. [illegible]08.

Snail, (garden) is surprisingly fitted for the life it is to live—organs of life it possesses in common with animals; and what peculiar to itfelf—every snail at once male and female; and while it impregnates another, is impregnated in turn—coupling of these animals—hide their eggs in great numbers in the earth, with great solicitude and industry—the growth of them—possessed of the power of mending the shell; and, come to full growth, they cannot make a new one—Swammerdam's experiment to this purpose—their food—salt destroys them; so

does soot—a tortoise in a garden banishes them most effectually—continue in a torpid state during the severity of winter—so great their multiplication in some years, that gardeners imagine they burst from the earth—wet seasons favourable to their production—*sea-snail*, *fresh-water snail*, and *land-snail*—common garden-snail compared with the fresh-water snail, and sea-snail—fresh-water snails viviparous—bring forth young alive, with shells upon their backs—experiment made by Swammerdam to this purpose—at all times of the year, fresh-water snails opened, are pregnant with eggs, or with living snails, or with both together—sea-snails found viviparous, others lay eggs—manner in which the sea-snails impregnate each other—different orifices or verges of snails—the difference between land and sea-snails—of the trochus kind, have no mouth—their trunk—are among snails, as the tiger, the eagle, or the shark, among beasts, birds, and fishes—food of all sea-snails lies at the bottom—of sea-snails, that most frequently swimming upon the surface, whose shell is thinnest, and most easily pierced, is the nautilus—its description—nothing seemingly more impossible, yet is more certain, than the nautilus sometimes quitting its shell, and returning to it again—peculiarity by which the nautilus is most distinguished, v. 214.

Snake, continues for several months together subsisting upon a single meal, ii. 3—snakes destroy mice, iii. 174—the only animal in the forest adventuring to oppose the monkey—larger snakes often winding up the trees where they reside, and happening to surprise them sleeping, swallow them whole, before they have time to make defence, 302. See *Serpents*.

Snake. (black) its description, and food—are oviparous, v. 375.

Snipe, a water-bird of passage—its description, iv. 382.

Snow, inhabitants of places where fields are continually white with snow, generally become blind before the usual course of [illegible]re, i. 12—its melting produces a constant breeze, [illegible]

S[illegible]slips, dreaded by travellers—a family in Germany lived [illegible] for a fortnight beneath one of those, i. 134.

Sobbing, is a sigh still more invigorated, i. 416.

Soft-finned fishes, their description, v. 126.

Soland-goose, belongs to the northern islands; in greatest number on the Bass-island, and subsists entirely upon fish, iv. [illegible]8. See *Gannet*.

Soldier-crab, like a lobster, without a shell—a native of the West India islands—description, and descent from the mountains, v. 177.

Sonorous bodies; those who make the tone of such bodies to depend upon the number only, and not the force of its vibrations mistake an effect for a cause, ii. 35.

Sore, name the hunters give the buck the fourth year, ii. 323.
Sorel, the hunters name for the buck the third year, ii. 323.
Sound, conveyed by air, is lost in vacuo, i. 277—sounding bodies of two kinds; unelastic returning a single sound, and elastic rendering a succession of sounds—undulations in elastic bodies, taken by the ear as one continued sound, while, in reality, they make many, ii. 34—those whose differences can most easily be compared, are most agreeable, 36—those musical most pleasing, which are most unexpected, 37—laws of the reflection of sound not so well understood as those of light, 40—persons of a bad ear often deceived as to the side whence sound comes—trumpets made to encrease sounds, 42.
Spalanzani, his experiments concerning the power of reproduction of animals, vi. 177.
Spaniels, land and water, the offspring of the beagle, transported into Spain or Barbary, so altered, and converted there—a dog of the generous kind, iii. 16.
Spanish-flies, described; their use in medicine, and as blisters, See *Cantharis*, vi. 152.
Sparrows, (house-sparrow)—various birds of the sparrow-kind—their food—songsters of this class—their migration, iv. 235—a male and its mate, that have young, destroy above three thousand caterpillars in a week, vi. 76.
Sparrow-hawk, one of the baser race of hawks, iv. 91—taught to fly at game, but little obtained from its efforts—lately asserted, upon respectable authority, the boldest of all for the pleasures of the chase, 99.
Sparus, the sea-bream, its description, v. 124.
Spawn, different seasons for fish to deposit their spawn, v. 23.
Spawning, peculiar preparation of the lamprey for spawning, v. 96.
Spears, the horns of the stag the third year, ii. 311.
Spermaceti, the oil of the cachalot easily converted into that concrete—efficacy of spermaceti in medicine very small—candles made of it substituted for wax, and sold cheaper, v. 51.
Spermaceti whale. The *Cachalot*, described, v. 50.
Spiders, in South America and Africa, as large as sparrows, i. 350—the spider, for several months together subsists upon a single meal, ii. 3—chief of our native spiders not venomous—their description, and habitudes—the Martinico spider's body as large as a hen's egg—manner of making their webs—Lister has distinguished the sexes of this animal—their coupling—their number of eggs—their bag to deposit their eggs—their parental care—enemies to each other—experiment made by Mr. Reaumur to turn their labours to the advantage of man—gloves made from their webs—found it impracticable to rear them, v. 396.
Spiders, (water) inhabit the bottom, yet never wet, but inclosed in a bubble of air, surrounding them on all sides, 407.

Spinal marrow and the brain, the first parts seen begun in the embryo, ii. 20.

Spinous class of fishes already extended to four hundred sorts, v. 117—Gouan's system and arrangement of the various sorts of spinous fishes—their general leading marks and difference from others—of those which live in the ocean, the dorado the most voracious, 119, 131.

Spirits (of wine) flame with a candle, not with a spark, i. 71.

Sponges, opinion of Count Marsigli about them—that of Rumph and Jussieu set in a clearer light by Mr. Ellis, vi. 193.

Spoonbill, descriptions of the European and American spoonbill—its manner of life, iv. 319.

Spouts (of water) at sea common in the tropical seas, and sometimes in our own—desription of one in the Mediterranean, by Tournefort—solutions offered for this phœnomenon—broken by guns firing bars of iron at them, which striking them, the water falls from them with a dreadful noise, and no farther mischief—those called typhons, sometimes seen at land, differ from those at sea described by mariners—description of that observed at Hatfield in Yorkshire, in 1687—land-spouts sometimes drop in a column of water at once upon the earth, and produce an inundation—they appear in the calmest weather at sea—facts still wanting to form a rational theory of them, i. 324.

Springs, (of water), experience alone can determine the useful or noxious qualities of every spring, i. 145—one mentioned by Derham, which he never perceived to be diminished in the greatest drought, when all ponds in the country were dry for several months, 167.

Squash, a stinka[illegible] of the weasel kind, called a pole-cat of America—its descr[illegible] id to eat only the brains of poultry—its scent strong enough to reach half a mile round; near hand, almost stifling—a drop of the fœtid discharge falling into the eye, might blind it for ever—dogs abate their ardour when they meet the fœtid discharge, turn, and leave the squash master of the field, never to be led on again—cows and oxen strongly affected by the stench; and provisions spoiled by it—with planters and native Americans, kept tame about their houses; seldom emitting disagreeable scents, except when injured or frighted—natives eat the flesh, taking care to clear it of the offensive glands, iii. 98, &c.

Squinting, many instances of squinting communicated by a father to his offspring, ii. 92.

Squirrel, the tails are extremely long, beautiful, and bushy, and serve them for several purposes—particularly in vast leaps of one hundred yards taken from tree to tree—when the animal eats, or dresses itself, it sits erect, like the hare or rabbit, making use of its fore feet as hands—the kind has as many varieties [illegible] y wild animal; enumeration of some—its way of

moving is by bounds—when tamed, is apt to break away at every opportunity—few animals so tender, or so unfit for a change of abode—some live on the tops of trees, others feed on vegetables below, where also they take shelter in storms—description of its qualities, food, and mansion—the nest formed among large branches, where they fork off into small—the martin destroys the squirrel, then takes possession of its mansion, iii. 136, &c.

Squirrels are in heat early in the spring, very diverting to see the female then feigning an escape from the pursuit of two or three males—time of gestation—keeps in the midst of tallest trees, and shuns the habitation of men—the tree but touched at bottom, they quit the nest, and fly to another tree; thus travelling with ease along the tops of the forest, until quite out of danger—in Lapland, vast numbers remove from one part to another—method of crossing broad rivers, or extensive lakes—they have a sharp piercing note, and another, more like the purring of the cat when pleased—the Laplanders eat their flesh—description of the *common sort*, and of the *grey Virginian kind*—the *Barbary; Siberian white; Carolina black; Brasilian; little ground Carolina*, and *New Spain squirrel;*—*flying squirrel* more common in America than in Europe—its food, and mansion, iii. 137, &c.

Stag, first in rank among quadrupeds; its elegant form described—no obvious difference between the internal structure of the stag and the bull, but to a nice observer—ruminates not so easily as the cow or sheep; reason why—manner of knowing its age—differ in size and horns from a fallow deer—increase in beauty and stature in proportion to goodness of pasture, enjoyed in security—seldom drinks in winter, and less in spring—different colours of stags—how watchfully he examines an enemy's approach—delighted with the sound of the shepherd's pipe—of animals natives of this climate, none have such a beautiful eye as the stag—beauty and size of horns mark strength and vigour—time and manner of shedding them—severe cold retards the shedding—horns increase in thickness and height from the second year of age to the eighth—shedding his horns, hides himself in solitudes and thickets, and ventures out to pasture only by night—grow differently in stags from sheep or cows—horns found to partake of the nature of the soil—a mistake that horns take colour of the sap of the tree against which they are rubbed—stag castrated when its horns are off, they never grow again; the same operation performed when they are on, they never fall off—one testicle only tied up, he loses the horn of the opposite side—Mr. Buffon thinks the growth of the horns retarded by retrenching the food—horns resembled to a vegetable substance, grafted upon the head of the stag—time of feeling impressions of the rut, or desire of copulation—effects the rut causes—stag lives about

forty years—voice in the time of rut terrible; and then keeps dogs off intrepidly—a stag and tiger enclosed in the same area, the stag's defence so bold, the tiger was obliged to fly—the stag, in rut, ventures out to sea from one island to another, and swims best when fattest, ii. 296—the hind, or female, uses all her arts to conceal her young from him, the most dangerous of her pursuers—men of every age and nation made the stag-chace a favourite pursuit—stags remaining wild in England, called red deer, found on the moors bordering Cornwall and Devonshire—manner of hunting stag and buck in England—different names given them, according to their ages—terms used by hunters pursuing the stag—the manner of knowing the track of a stag; and that of a hind—he changes his manner of feeding every month; in what manner—swims against the stream—the antient manner of pursuing him—that of hunting him—and in China—stag of Corsica—a kind called by the antients *tragelaphus*—Germans call it *bran-deer*, or *brown deer*—a beautiful stag, thought a native of Sardinia, though perhaps of Africa, or the East-Indies—its description—*stag royal*, in Mexico—*of Canada*, brought into the state of domestic tameness, as our sheep, goats, and black cattle, 306, &c.

Staggard, name of the stag the fourth year, ii. 311.

Stare, bird classed with the thrush; distinction from the rest of its tribe—its residence—its eggs—it is easily taught to speak—its food, iv. 253.

Star-fish, general description of the tribe—substance of their bodies almost as soft as water—no way injured by swallowing shells almost of a stony hardness—float upon the surface of the sea, and in the dark send forth a shining light, resembling that of phosphorus—called *sea-nettles*—the passage for devouring food serves to eject excrements—taken and put into spirits of wine, continue many years entire; but left to influence of air, in four-and-twenty hours melted down into a limpid offensive water—cut in pieces, every part survives the operation, becoming a perfect animal, endued with its natural rapacity, vi. 180

Starling, time of migration iv. 24—often lays eggs in holes deserted by the wood-pecker, 194—slender-billed bird of the sparrow kind, living upon insects, 246.

Stars (fixed), supposed by philosophers suns resembling that which enlivens our system, i. 5.

Stars (falling), meteors, or [illegible] as vapours raised from the earth, kindled and supported in the air, until they fall back extinguished, i. 333.

Stature, middle in men, from five feet five to five feet eight inches, i. 428—ordinary of men, Mr. Derham observes, probably the same now as at the beginning—many corroborating proofs of this, ii 111.

INDEX.

Steno, his opinion about the formation of the incipient animal, i. 358.

Stickleback, the gasterosteus of the prickly-finned thoracic sort; description of this fish, v. 125—this fish appears in quantities every seventh or eighth year in the river Welland, near Spalding: a man, employed by a farmer to take them, for manuring his grounds, got, for a considerable time, four shillings a day, selling them at a halfpenny a bushel, 144.

Stigmata, holes through which caterpillars breathe—famous experiment of Malpighi to verify this, vi. 53.

Stinkards, name given by our sailors to one or two animals of the weasel kind, chiefly found in America, iii. 98—and by the savages of Canada to the mufk-rat, 180.

Stint, smaller and shorter billed water-bird of the crane kind, iv. 332.

Stoat, the ermine, its description, iii. 76.

Stomach, nature has contracted the stomachs of animals of the forest, suitable to their precarious way of living, ii. 2—proportioned to the quality of the animal's food, or the ease of obtaining it—those who chew the cud have four stomachs—yet several of those have but two in Africa, 152—names of the four stomachs—stomachs of carnivorous animals small—those of ruminating, strong and muscular—of insects, composed of muscular fibres, 219—the camel has a fifth stomach, as a reservoir of water for occasional use, iii, 375—birds have, properly, but one stomach, yet this is different in different kinds, iv. 11—that of the cuckoo enormous, reaches from the breast-bone to the vent, 205. See *Animals*.

Stone-chatter, slender-billed bird of the sparrow kind, iv. 247—migrates, 249.

Stones, shower of stones and other matters raised by storms in one country, carried to another, fall suddenly as showers of rain, i. 333—falling from the atmosphere after the explosion of meteors, i. 339.

Stork, true difference between it and the crane—are birds of paffage—returning into Europe in March—places for their nests—number of eggs—are a month in hatching; and, their young excluded, they are particularly solicitous for their safety—their food in a great measure frogs and serpents—the Dutch attentive to the preservation of the stork, in their republic the bird protected by the laws and the prejudices of the people—countries where found—ancient Egyptians regard for this bird carried to adoration—the ancient ibis supposed the same which at present bears the same name; a bird of the stork kind, about the size of a curlew, iv. 299.

Storms foretold by the barometer, i. 291—above their region all is calm and serene—rise to the tops of the highest mountains—confirmed by those who have been on the Andes, and by the deep snows that crown them, 292—with powerful effects, do

not shew great speed, 294—one most dreadful in Hertfordshire, in 1697—description of it, 321.

Stove, its warmth expeditious for hatching, and efficacious in bringing the animal in the egg to perfection, i. 366.

Strabiſm, an inequality of sight, and particular cast of the eye; whence it proceeds, ii. 28.

Stream of Rivers, more rapid in proportion as its channel is diminished, and why, i. 171—the surface swifter than the bottom, and why—islands, turnings, and other obstacles retard the course but inconsiderably, and why, 172.

Strength, a just way of estimating human strength, by perseverance and agility of motions—not hereditary—prodigies of it in Milo, and also in Athanatus—estimation of strength in Maximin, the emperor, described—instance of it in animals by the bulk of their muscles very fallacious; thin and raw-boned men being generally stronger and more powerful than those seemingly more muscular—women much inferior in strength to men—of man less valuable since the invention of gun-powder, of new machines, and the application of the power of animals to the purposes of life—the comparative strength of a horse measured, not by what he can carry, but by what he can draw, i. 433—of the inhabitants round the poles is amazing, ii. 75.

Stromateus, a soft-finned apodal fish, described, v. 127.

Struthophagi, some nations so called from their fondness for the flesh of the ostrich—their method of taking it, iv. 45.

Stuffs made of hair of animals about Angora, ii. 265—half composed of silk forbid to be worn at home, as a luxurious refinement, vi. 80.

Stunts, name given to whales at the age of two years, v. 38.

Sturgeon, a cartilaginous fish, of a considerable size, yet flies terrified from the smallest fishes—its description—countries of Europe this fish visits at different seasons—annually ascends the largest rivers to spawn, and propagates in vast numbers, enjoying the vicissitude of fresh and salt water, then grows to an enormous size, almost to rival the whale—the largest caught in Great Britain taken in the Eske, were frequently found weighing four hundred and fifty pounds—places where caught in numbers—never by a bait, always in nets—their food—whence the German proverb, *He is as moderate as a ſturgeon*—live in society among themselves; and Gesner has seen them shoal together at the notes of a trumpet—usual time of coming up rivers to spawn—at Pillau the shores formed into districts, and allotted to companies of fishermen, and rented, some for three hundred pounds a year—nets in which caught—in the water it is one of the strongest fishes, and often breaks the nets that enclose it, but its head once raised above water, its activity ceases—has broke fishermen's legs with a blow of its tail—two methods of preparing it—that from America not

so good as from the north of Europe—caviar made with the roe of all kinds of sturgeon—manner of making it, v. 98.
Sucking fish, the remora, sticks to the shark—also called the shark's pilot, and why, v. 74.
Sucking-fish, the echeneis, a soft-finned thoracic fish, its description, v. 127.
Suction, from whence that amazing power in the lamprey arises, v. 95.
Sugar, the white sort, in the tropical climates, sometimes full of maggots, i. 259.
Sulphur, with iron filings, kneaded together into a paste, with water, when heating, produces a flame, i. 66.
Sun, mock-suns and other meteors seen in the Alps, i. 121—in the polar regions, 323—reflected upon opposite clouds, appear like three or four real suns in the firmament—real sun always readily known by superior brightness—the rainbow also different in those countries, 332—its warmth efficacious in bringing the animal in the egg to perfection, 366—not easy to conceive how it whitens wax and linen, and darkens the human complexion, ii. 89.
Sun-fish, an anomalous cartilaginous fish, like a bulky head, its description, v. 106.
Surf (of the sea) name the mariners give the rising waves breaking against the shore, i. 227.
Surinam-rat, the phalanger, a small monkey, described, iii. 327.
Surinam-toad, the pipal, a hideous toad, its description, v. 285.
Surmalot, with Mr. Buffon, the great rat, a hateful rapacious creature, described, iii. 168.
Surmulet, the mullus, a spinous fish, its description, v. 124.
Swallow, time of their migrations—departure of some, and retreat of others into old walls, from the inclemencies of winter, wrap the migrations of birds in great obscurity, iv. 28—experiment of Mr. Buffon to this purpose, 28—with us birds of passage; breed in Upper Egypt and the Island of Java, and never disappear, 250—*House-swallow*—characteristics of the swallow-tribe—their food—have the greatest swiftness and agility—at the end of September they depart; some feeble wretched families, compelled to stay, perish the first cold weather—those migrating first seen in Africa in the beginning of October, having performed their journey in seven days——sometimes seen, interrupted by contrary winds, wavering in their course at sea, and lighting upon the ſhips in their passage—a doubt whether all swallows thus migrate, or some other of this species externally alike, and internally different, be differently affected by the approach of winter—observations made to this purpose by Reaumur, Frisch, and Klein—indicate approaching change of weather—their nests, and those they build on the coasts of China, and Coromandel—Chinese pluck them from rocks, and send great numbers into the East

Indies for sale—gluttons esteem them great delicacies dissolved in chicken or mutton broth—the number of their eggs, 270, &c.

Swan; a stately web-footed water-fowl; though an indifferent figure upon land, is beautiful in the water—doubt whether the tame kind be in a state of nature—none found in Europe—the wild swan, though strongly resembling it in colour and form, yet another bird—differences between wild and tame swans—considered a high delicacy among the ancients—the tame most silent, the wild has a loud and disagreeable note—from thence called the hooper—accounts sufficient to suspend an opinion of its musical abilities—their food, nest, and number of eggs—a blow with the pinion breaks a man's leg or arm—two months hatching, and a year growing to proper size—longest in the shell of any bird—said to live three hundred years—by an act of Edward IV. the son of the King was allowed to keep a swan, and no others, unless possessed of five marks a year—punishment for taking their eggs was imprisonment for a year and a day, and fine at the king's will—places which abound with them, iv. 399.

Swarms (of a bee-hive) several swarms in the year, the first always the best and most numerous, vi. 108.

Sweetmeats, in tropical climates, exposed by day in the sun, to prevent their putrifying by the night air, i. 259.

Swift, a bird of the swallow kind; peculiar position of the toes, iv. 271.

Sword-fish, the xiphias, its description, v. 122—its terrible encounters with the whale described, 40.

Syagushes, carnivorous animals, like the jackall and wolf; hunt in packs, and encourage each other by their cries, ii. 156—its description, 436.

Symmetry and proportion of the human body, i. 406.

Sympathetic affection of yawning, i. 415.

Synovia, a lubricating liquor in the joints, so called by anatomists, i. 429.

System, in what manner the harmony of our planetary system is preserved, i. 3—very useful in natural history—books containing them useful to be consulted, but unnecessary to be read—that of Linnæus deserves the preference—faults of systematic writers in natural history, ii. 130—what has given birth to the variety of systems in natural history, 139.

T.

Tabbies, streaked cats, to which the civet's colour is compared, iii. 105.

Tadpole, the larva of the frog, v. 264.

Tajacu, the peccary, an animal of the hog kind, peculiar for a

lump upon its back, with glands discharging a musky substance, ii. 367.
Talapoin, eighth division of monkies of the ancient continent—its description, iii. 313.
Talons, in what manner produced in animals, i. 423.
Tamaim, a monkey of the second sort of the sagoin kind—description, iii. 316.
Tamandua, an ant-bear, larger and smaller, live upon ants—their description, iii. 398.
Tamis-bird, one of the names of the Guinea-hen, described, iv. 148.
Tanrec, of the hedge-hog kind, different enough to constitute another species—covered with prickles, though mixed with hair—does not defend itself by rolling up in a ball—only found in the East-Indies—sleeps several months, and loves to be near water—in the torpid state its hair falls off—Indians consider its flesh a delicacy, iii. 202.
Tapeti. See *Rabbit* (Brasilian), iii. 160.
Tapir, the largest animal of America, no way comparable in size to the elephant of Africa, ii. 164—considered as the hippopotamos of the new continent—its description—resides in the water—its food—its flesh thought a delicacy, iii. 393.
Tarantula, the bite of this animal, and its cure by music, all a deception—instance of it—native of Apulia in Italy—description—its bite not attended with dangerous symptoms—fables of its virulence, v. 408.
Tarcel, name falconers give the male bird of prey; and why, iv. 63.
Tariguagua, ruggedness of road from it up to the Andes, not easily described, i. 124.
Tarsier, a monkey, last of the class of the oppossum kinds—its description—why so called, iii. 328.
Tartars, their religion consists in part by managing their whiskers—they waged a bloody war with the Persians as infidels, not giving their whiskers the orthodox cut, i. 419—the Ostiac, a race travelled down from the North, and originally sprung from minute savages, ii. 76—Samoeid, first distinct race of men round the pole, described, 72.
Tartary, in general, comprehends great part of Asia—description of natives and manners, ii. 77.
Taste, to determine somewhat upon the nature of tastes, bodies to be tasted must be moistened, or dissolved by saliva, to produce a sensation; the tongue and body to be tasted, being dry, no taste ensues—tastes rendered agreeable by habit—relish of tastes stronger in children than in persons advanced in life—highest epicure has the most depraved taste, ii. 49.
Tatou, or armadilla, a quadruped of the new continent, covered with shells, iii. 218. See *Armadilla*.
Tatu-apara, first of the kinds of armadilla—the second, the

tatou of Ray, or the encoubert of Mr. Buffon—the third, the tatuette—their diversities described, iii. 224.

Taylor-warbler, a bird that sews up a leaf into a kind of cone in order to form its nest, iv. 199.

Teal, smallest bird of the duck-kind, distinguished, iv. 412.

Teats, great variety of them in animals—their form, and how placed, i. 424.

Teeth of animals various—how formed in man, i. 423—of the elephant, shed like horns of deer, or obtained after death, not yet known—natives of Africa find them in their forests, iii. 355—of the narwhal surpasses ivory—ascribed to a different animal—curiosity, and the desire of scarce things, made them very valuable a century ago, v. 47—the white shark is said to have one hundred and forty-four teeth, v. 68.

Tegg, what the hunters call the doe the second year, ii. 323.

Tejuguacu, tockay, and cordyle, all of the lizard kind, gradually less, fill up the chasm between the crocodile and the African iguana, v. 316.

Tempests, loudest formed by united contributions of minerals, vegetables, and animals, encreasing the streams of air fleeting round the globe, i. 280—frequent under the tropics, and a space beyond them—tempests of sandy deserts raised in one country, and deposited on another, 294—in Arabia and Africa described, 300.

Tendrac, an animal less than a mole, different from the hedge-hog, and a different species—description—grunt like hogs, and love to be near water—they multiply in numbers—sleep several months—its flesh a great delicacy with the Indians, iii. 202.

Terrier, a small kind of hound, iii. 14.

Teuthys, a spinous fish, v. 126.

Testaceous substances, in variety on the tops of mountains, and in the heart of marble, i. 13.

Thales, the philosopher, held all things made of water, i. 140.

Thames-water, and that of the Indus, most light and wholesome, i. 143.

Theories (of the earth), those of the most celebrated authors, i. 17.

Theory (of evaporation), for the formation of clouds, i. 314—other theories upon that subject, 313—theory of sympathy, of father Mallebranche, beautiful upon monstrous productions, ii. 96.

Thermometer, measures heat and cold by a fixed standard—description, i. 149.

Theutys, a prickly-finned abdominal fish—description of it, v. 126.

Thoracic-fish, that which has the ventral fins directly under the pectoral fins, v. 120.

Throat (of the great Greenland whale) is so narrow, that any animal larger than a herring could not enter, v. 39—but that of the cachalot can with great ease swallow an ox, 51—that of the shark most amazing, 68.

Thrush, a slender-billed bird of the sparrow kind, iv. 246—its distinction from all of the kind—its song very fine—the largest of the tribe with a musical voice—its food, 251.

Thumb-footed shell-fish, testaceous, described, v. 250.

Thunder, Ulloa heard it rolling beneath him, when upon the Andes, i. 127—its cloud always moves against the wind, 291—a sound produced by the opposition of two clouds, and continued by reverberated echo, 319—thunder clears the air, and kills insects noxious to vegetation, 321.

Thuroid (cartilage) forms a lump upon the wind-pipe in men, not seen in women, i. 424.

Tides, the most obvious motion of the sea—with Pliny, were influenced partly by the sun, and in a greater degree by the moon—Kepler first conjectured attraction the principal cause of them—the precise manner discovered by Newton—high tides happen at the same time, on opposite sides of the globe, where waters are farthest from the moon—solar and lunar tides—greatest in syzigies, least in quadratures—flows strongest in narrowest places—Mediterranean, Baltic, and Black Sea, no sensible tides, the gulph of Venice excepted; and why—higher in the torrid zone, than in the rest of the ocean—greatest at the river Indus, rising thirty feet—remarkably high on the coast of Malay, in the streights of Sunda, the Red Sea, the gulph of St. Lawrence, along the coast of China and Japan, at Panama, and in the gulph of Bengal—those at Tonquin most remarkable in the world; one tide, and one ebb, in twenty-four hours; twice in each month no tide at all—in the streights of Magellan it rises twenty feet, flows six hours, and the ebb lasts but two hours, i. 208.

Tiger, leaps twenty feet at a spring, ii. 156—often bigger than the lion—nothing tames it—perfectly resembles the cat, 409—the royal tiger—carries a buffalo over its shoulder to its den, 416—attacks the lion, 402—taught to defend herds, 380—said to follow the rhinoceros for its excrements, 411—other tales about it—under Augustus, a tiger an extraordinary sight—the species scarce—opinion of Varo, that it was never taken alive, 417—the ancients commended it for beauty among quadrupeds, equal to that of the peacock among birds, 409—supposed to bring forth four or five young at a time—expresses his resentment as the lion—the skin esteemed in the East, particularly in China, 418—battle of one tiger and three elephants at Siam described, 414—another between a tiger and a crocodile, 421—the red tiger, Mr. Buffon's cougar, 419—common in Guiana, Brazil, Paraguay, and other parts of South America—the flesh superior

to mutton, 422—and esteemed by the negroes as a dainty, iii. 23.

Tiger-cat, or cat-a-mountain, the ocelot of Mr. Buffon—a beautiful animal, ii. 428.

Tipula, (water) of the second order of insects—description of it, vi. 34.

Tipula, long legged gnat, description of this insect—only difference between it and the gnat, vi. 169.

Titmouse, a slender-billed bird of the sparrow kind, iv. 246.

Toad, some bigger than ducks, i. 350—their flesh eaten as a delicacy on the coast of Guinea, iii. 23—differences between the frog and it, as to figure and conformation, v. 257—their nature, appetites, and food—coupling—difficulty in bringing forth—curious particulars relating to this animal—one swallowing a bee alive, the stomach stung, and the insect vomited up again—toads not venomous—accounts of toads taken inwardly—a harmless, defenceless creature, and unvenomous—torpid in winter—retreat then—difficult to be killed—lives for centuries in a rock, or within an oak, without access, nourishment, or air, and yet found alive and perfect—accounts of this—toads suck cancerous breasts, and perform a cure—progress of this operation—the rubeth, the land-toad alone has the property of sucking—doubtful whether they die by internal or external application of the cancerous matter—varieties of the animal—description of the Surinam toad, called pipal, v. 272—one taken out of the belly of a snake at Lord Spencer's, 350.

Toes, usually four in all animals of the poultry kind; in a species of cock amount to five, iv. 124.

Tongue, (of the rein-deer), a great delicacy, ii. 354—the flamingo's much celebrated and larger than that of any other bird, iv. 326—of the great Greenland whale, fills several hogsheads with blubber, v. 35.

Tornado, a formidable tempest, so called by the Spaniards—its description and dreadful effects, i. 299, 308.

Torpedo, its description—by an unaccountable power, the instant touched, even with a stick, when immediately taken out of the sea, it numbs the hand and arm, or whole body—the shock resembles an electrical stroke; sudden, tingling, and painful—account by Kemfer of numbness produced by it—he believes holding in the breath prevents the violence; implicit belief of efficacy would be painfully undeceived—this power not exerted upon every occasion—trials by Reaumur to this purpose—opinions concerning the cause of this strange effect—the fish dead, the power destroyed, then handled or eaten with security—the power not extended to the degree some believe, reaching the fisherman at the end of the line, or numbing fishes in the same pond—ridiculous excess of this numbing quality in the history of Abyssinia, by

Godignus—Lorenzini, from experiments, is convinced the power resides in two thin muscles of the back—several fishes have acquired the name of Torpedo, possessed of the same quality——Moore's and Condamine's accounts of them, v. 86.

Tortoise, ranked among crustaceous fishes, though superior to them all—amphibious, according to Seba—distinguished in two classes, the *land-tortoise*, and the *sea-turtle*—differ more in habits than conformation—description—principal distinctions—varieties are, *trunk-turtle*, *loggerhead*, *hawk's-bill*, and *green-turtle*—the shell never changes, and growing with the body is formed in pieces—all generally found in warm countries without retiring—a defence against dangerous attacks—the blood warm and red—how circulated—turtle larger than tortoise—weighs from fifty to five hundred pounds—ancients speak of some of amazing sizes—live to eighty and a hundred and twenty years—can live without limbs, head, or brain, proved by experiments of Redi—moves with great weight upon it—hears distinctly, by means of an auditory conduit opening into the mouth—sighs when ill situated, and sheds tears when distressed—torpid during winter, sleeping in some cave, and breathing imperceptibly—account of a land tortoise caught in a canal at Amsterdam—and of a turtle in the Loire in 1729, v. 180. See *Turtle*.

Toucan, a bird of the pie kind, has a large bill—the red-beaked described—its food—pepper voided unconcocted by the toucan, preferred to that fresh gathered—Pozzo bred one tame—its habits and food—has birds, men, monkies, and serpents to guard against—scoops out its nest into the hollow of some tree, leaves scarce room to go in and out, and with its great beak guards that entrance—found only in warm parts of South America, where it is valued for its tender and nourishing flesh, and the beauty of its plumage, particularly the breast, the skin of which the Indians dry and glue to their cheeks for beauty, iv. 187.

Touch, those parts of the body most exercised in touching, acquire the greatest degree of accuracy—the fingers, by long habit, not from a greater quantity of nerves, become masters in the art, ii. 50.

Trachinus, the weaver, a prickly-finned jugular fish, described, v. 122.

Trachipterus, the sabre, a prickly-finned thoracic fish—its description, v. 125.

Track (of a stag), manner of knowing it, and that of a hind, ii. 313.

Tragelaphus, name of a stag with the ancients—found in the forests of Germany, and called by the natives bran-deer, or the brown-deer, iii. 318.

Traps (for horses), used by the Arabians for the wild sort, ii. 177

for wild asses, also used in the Archipelago, 200—for mice, described in variety by Gesner, iii. 175.

Treacle, food for bees during winter, when robbed of their honey, vi. 99.

Trees, (fossil) in the body of solid rocks, and deep under the earth upon which they once grew—conjectures upon this subject, i. 43—found in quantities at the mouth of the river Ness in Flanders, at the depth of fifty feet, 233—laying twenty feet deep under ground for many ages, become hard and tough, proofs of alternate overflowings and desertions of the sea, 236—usually of the largest kinds in wide uncultivated wildernesses, in the state of rude nature, 353—the banana and plantane, so immense, as to be inimically inhabited by monkies, snakes, and birds of most delightful plumage, iv. 195—age known by the number of their circles, v. 20.

Trichurus, a prickly-finned apodal fish, of a sword-like form, described, v. 121.

Trigla, the gurnard, of the spinous kind, description of this fish, v. 124.

Trochus, the snails of that kind have no mouth—their trunk—are, among snails, what the tiger, eagle, or shark are among beasts, birds, or fishes, v. 225.

Troglodyte (of Bontius), is the ouran-outang, or wild man of the woods, iii. 277.

Tropical-seas, supposed by Linnæus the native spot of man, and the northern climates only places of sojourning for them—an argument sufficing to prove the contrary, ii. 93—the climates so hot, dogs in process of time lose the delicacy of their scent entirely, and why, ii. 433.

Trumpeter, a curious bird of South America, iv. 164.

Trumpets increase sounds, in the same manner as the telescope does bodies—persons hard of hearing find the same advantage in the trumpet made for this purpose, that the short-sighted persons do from glasses; were they farther enlarged they could be used to advantage only in a place of solitude and stillness, as the multitude of sounds would produce tumult and confusion, ii. 42.

Trunks (of animals), that of the elephant described, iii. 338—that of the gnat may justly be deemed one of nature's masterpieces, vi. 161.

Tubes (of glass), drawn as fine as a hair, still preserve their hollow within, i. 161.

Tufted-duck, a variety of the kind, native of Europe, iv. 411.

Tumble-dung, a strong beetle, remarkable for make and manners, vi. 149.

Tumbler, in the division of Dr. Caius, a dog of the first class, or generous kind, iii. 13—supposed the lurcher, and described, 15.

Turbinated-shells, are univalves, and the first kind of Aristotle's division, v. 209.

Turbits, variety of the tame pigeons, obtained by cross breeds, iv. 231.

Turbots, (and rays) extremely delicate in their choice of baits; a piece of herring or haddock, twelve hours out of the sea, and used as a bait, will not be touched, v. 83.

Turkey, (bird of the poultry kind) its native country disputed; arguments for the old and new continent—first seen in France in the reign of Francis I. and in England in that of Henry VIII.—its tenderness with us, when young, argues not for our climate—in the wild state, hardy and numerous in the snowy forests of Canada—also larger and more beautiful than in the domestic state—the savages weave the feathers into cloaks, and fashion them into fans and umbrellas—hunting the turkey a principal diversion with them, its flesh chiefly supporting their families—manner of hunting, iv. 136.

Turkies, a stupid, vain tribe, quarrelling among themselves—the cock's antipathy to red—bristles, and flies to attack it—manner of increasing their animosity for diversion—weak and cowardly against the weakest animals that dare face them—the cock pursues what flies from him, as lap-dogs and children, then returns to his train, displays his plumage, and struts about—the female milder, gentler, and particularly fond of ants and caterpillars eggs—lays eighteen or twenty eggs, larger than a hen—the young very tender at first, must be carefully attended to—account of Abbé Pluche, of a turkey-hen and her brood at the sight of a bird of prey—turkies of Norfolk the largest of this kingdom, some weigh thirty pounds; in East India, in domestic state, grow to weigh sixty pounds, iv. 138.

Turkish-dog, without hair, iii. 18.

Turn-spit, a dog of the mongrel kind, and the lower class of Dr. Caius's division, iii. 13.

Turn-stone, a small bird of the crane kind, iv. 332——likes colder climates in summer, or wildest and moistest parts in this country—is a bird of passage, 336.

Turtle, prepares for laying, and deposits her eggs in the sand, where in twenty-six days they are hatched by the sun—lay from one hundred and fifty to two hundred in a season—the young from the egg, with their shell, seek their food untaught, and, at the size of quails, run by instinct to the sea, ignorant of all danger, v. 188—propagated on shore only—comes from sea on purpose in coupling season—female is passive and reluctant; the male is slow, but grasps so fast, nothing loosens the hold, 195.

Turtle, (article of commerce), the shell put to many uses; of the *hawk's bill* the finest; consists of eight flat, and five hollow plates—how manufactured—the flesh, particularly of the

green turtle, prized as a delicacy, and is wholesome—the *great Mediterranean* the largest of all, unfit and unsafe to eat; its shell is unprofitable for use—several ways of catching turtles, v. 190.

Turtle-dove, one of the ruminating birds, or with a power of disgorging food to feed its young, ii. 221.

Tusks, those of a boar sometimes a foot long, ii. 359—of the babyrouessa, a fine ivory, smoother and whiter than the elephant's, but not so hard—of enormous size, 377—of castrated animals, scarce appear without the lips—broken, abate his fierceness and venery, producing nearly the same effect as castration, 379—of the mammouth, weigh four hundred pounds; those of the elephant from Africa, two hundred and fifty—some remarkable, lately found near the Ohio and Miume, in America—Dr. Hunter thinks them of a larger animal than the elephant, iii. 356—of the narwhal, or sea-unicorn, a cetaceous fish, with teeth from nine to fourteen feet long, v. 46.

Twins, never, while infants, so large or strong as children that come singly into the world, and why, i. 383.

Typhons, spouts so called, seen at land, differ in several respects from those at sea, i. 337.

Tyson, (Dr.) his description of an ouran-outang, by the name of *pygmy*, the best and most exact, iii. 278.

V.

Valerian, a plant of which cats are excessively fond, ii. 386.

Vampyre, a foreign bat, having the reputed faculty of drawing blood from persons asleep; and thus destroying them before they awake, iii. 233. See *Bat*.

Vapour, of metals in mines not so noxious as those of substances with which ores are usually united, such as arsenic, cinnabar, &c.—fragrance of their smell—warnings about them, i. 68—disengaged from water, and attenuated, ascends into the atmosphere, where condensed, and acquiring weight as it rolls, falls down in a shape suitable to the temperature of its elevation, 316.

Vari, a kind of maki, last of the monkey kind—its description, iii. 319.

Vault, *go to vault*, phrase used by hunters, when the hare enters holes like the rabbit, iii. 123.

Vegetables, vegetable earth—the bed of it, in an inhabited country, must be always diminishing, and why, i. 50—plant, with a round bulbous head, which, when dried, becomes of amazing elasticity, grows near the extremity of that region, on mountains, where continual frost reigns, 126—like fluids and mineral substances, produce air in a copious manner, 262

—totally unprotected, and exposed to every assailant, 346—those in a dry and sunny soil, are strong and vigorous, not luxuriant; and those the joint product of heat and moisture, are luxuriant and tender—different kinds appropriated to different appetites of animals, and why—birds distribute the seeds of vegetables where they fly, 349—vegetables cover the bottom of many parts of the sea, 350—but few noxious—that life as much promoted by human industry, as animal life is diminished, 355—the sole food of ruminating animals, ii. 217—animals feeding on vegetables most inoffensive and timorous, iii. 117—some possessed of motion—what constitutes the difference between animal and vegetable life, difficult, if not impossible, to answer, vi. 169—not possessed of one power which animals have, the actual ability, or aukward attempt at self-preservation, 170—those called marine grow to a monstrous size, 183.

Vegetation, anticipated in its progress by bees, vi. 99.

Velocity, not alone the actuating force of winds, but also the degree of density, i. 293.

Velvet-duck, a variety of the common duck, a native of the European dominions, iv. 411.

Vermin, hospitals erected in India for the maintenance of all kinds of vermin, ii. 81.—less found with asses, than with other animals covered with hair, 207. See *Bramins*.

Vesuvius, its eruption—the most remarkable described by Valetta, i. 78—another account by Bishop Berkeley, 80.

Vibrations (of a bell), cease to be heard when under the receiver of an air-pump, i. 277—the tone of a sonorous body made to depend upon the number of vibrations, not the force, is a mistake of an effect for a cause, ii. 35.

Violet-crab, of the Caribbee islands, most noted for shape, delicacy of flesh, and singularity of manners, v. 171.

Viper, most vivacious of reptiles—experiment on a viper in the receiver of the air-pump by Mr. Boyle, i. 261—kept in boxes for six or eight months without any food—its progressive motion, v. 361—the only animal in Great-Britain whose bite is feared—do not devour their young—their food—by the application of sallad-oil, the bite of the viper effectually cured—who first discovered the remedy—effects of the viper's bite, v. 359.

Vision, its errors—objects represented upside-down, and double, ii. 20—the point without sensation—and want of measure for distance, 23.

Viviparous and oviparous animals, the two classes for generation and production—all other modes held imaginary and erroneous, i. 362—the blenny, a spinous fish, brings forth two or three hundred young at a time, alive, and playing around, v. 21.

Unan, one of the two kinds of the sloth, an animal about the size of a badger, iii. 402.

Understanding, comparative progress of it—greater in infants, than in children three or four years old, i. 392.

Undulations, (in elastic bodies), supposed by the ear one continued sound, though in reality many, ii. 33.

Unicorn (of the sea), a whale with teeth in the upper jaw, its description, v. 46. See *Narwhal*.

Univalve shells, first division by Aristotle, as to figure, v. 209.

Voice (of birds) much louder for their bulk than animals of other kinds—some set to music by father Kircher, iv. 111.

Volcano, considered as a cannon of immense size, the mouth near two miles in circumference—opinions of philosophers and ignorant men about it—the real causes—three very remarkable in Europe, and which, i. 75—Albouras, most famous in Asia—one in the island of Ternate—in the Molucca islands, in Japan, in Java, and Sumatra, in the Cape de Verd islands, the peak in Teneriffe; also in America, 84—marine ones not very frequent, and why, 109.

Vomit (black), a mortal symptom of the distemper called chapatonadas, in America, i. 267.

Uranofcopus, a prickly-finned apodal fish, description of it, v. 122.

Urchins, or echini, a multivalve shell-fish—manner of exhibiting this extraordinary animal in every light—its description—some kinds as good eating as the lobster, and its eggs considered as a great delicacy, v. 248.

Urine (of animals) found efficacious in some disorders, ii. 375—of the lion, insupportable, 401—of camels, an ingredient in sal ammoniac, iii. 378—of birds, differs from that of other animals, iv. 13.

Urson, or *Hudfon*, of the hedge-hog kind, a native of Hudson's Bay—its description—sleeps much, and feeds upon the bark of juniper—in winter snow serves it as drink, and in summer it laps water like a dog, iii. 211.

Urus and *bison*, in fact, descendants of one common stock; and naturalists, assigning them different classes, have separated what is really united—this wild bull chiefly met with in Lithuania—description of it—generally taken by pit-falls, ii. 228—the breed chiefly occupies the cold and temperate zones, 234.

Vulture-kind, vulture and dog, about Grand Cairo, in Egypt, keep together in a sociable friendly manner, and bring up their young in the same nest, iii. 28—its distinctive marks from other kinds of carnivorous birds—the flesh liked, and dressed for eating, according to Belonius, iv. 64—of Senegal, said to carry off children, probably no other than the condor—seldom attacks living animals, when supplied with dead, 81—description of the golden vulture, 82.

Vulture, (bird of prey), next in rank to the eagle, less generous

and bold, iv. 81—countries where found—unknown in England—flocks of them near Grand Cairo, not permitted to be destroyed, as they devour all the filth and carrion there—in company with wild dogs, tear and devour together without quarrelling—wonderful method of separating the flesh from the bones, and leaving the skin intire—smell carrion from afar—follow those that hunt for skins alone, and so voraciously fill themselves, as merely to waddle, and to want disgorging before they fly away—are little apprehensive of danger, and allow themselves to be approached—an eagle falling in upon their meals, keeps them at distance till he be satiated—an ox returning home alone, lying down by the way, becomes their prey, and is devoured alive—attempt oxen grazing, destroy lambs, and feed much upon serpents, rabbits, hares, and what game they can overpower—demolish whole broods of crocodiles—lay two eggs at a time, and produce but once a year—make nests in inaccessible cliffs, and remotest places—their flesh lean, stringy, nauseous, tasting and smelling of carrion—the down of their wings make a pretty kind of fur, commonly sold in the Asiatic markets, 83, &c.

Vultures (king of), description of this bird, iv. 87.

W.

Walfischoas, whales provender, insects floating in clusters on the surface of the sea, and called medusa by Linnæus, v. 39.

Walnut-trees, with walnuts on the stems, leaves, and branches, in exact preservation, found at twenty-six feet depth, round the city of Modena, in Italy, i. 235.

Wanderow, a baboon less than the mandril, its description—chiefly seen in the woods of Ceylon and Malabar, iii. 298.

Wappe, dog of the mongrel kind, in the third division of Dr. Caius, iii. 13, 17.

Warbling (of birds,) so loud and various in modulation, not easily accounted for, iv. 11.

Warine, the Brasilian guariba, largest of the monkey kind, found in America—its description, iii. 314.

Warree, hog of the isthmus of Darien, described by Wafer, ii. 378.

Wasps, their description and habits—their habitation scarcely completed, when the inhabitant dies—have two or three hundred queens in a hive—their nest a most curious object—the social wasps gather no honey themselves, though fond of sweets—fierce battles with the bees, who make up by conduct and numbers the deficiency of prowess—their depredations—where found, other flies desert the place—live but one season—cannot endure winter—before new year they wither and die, having butchered their young—in every nest, one or two females

survive—impregnated the preceding season, she begins in spring to lay eggs, and before June produces ten thousand young, which are nursed and fed by her alone—solitary wasp, its manners—provisions made for the young at leaving the egg —the provisions arranged and laid in, the old one closes the hole and dies—the young leaving the egg, are scarcely visible —how the life of the young is spent—wasps of Europe innocent, compared to those of tropical climates—description of those of the West-Indies, and their habits—pains of their sting insupportable, more terrible than of a scorpion; the part swells, and people are so disfigured as scarce to be known, vi. 115.

Water, its parts infinitely small, driven through the pores of gold, penetrating through all substances, except glass—enter the composition of all bodies, vegetable, animal, and fossil—birds, beasts, fishes, insects, trees and vegetables, with their parts, have growth from it, and by putrefaction become water —gives all other bodies firmness and durability—a phial hermetically sealed, kept fifty years, deposed no sediment, and continued transparent—gathered after a thunder-clap, in sultry weather, deposits a real salt—spring water collected from the air—of river waters, the Indus and the Thames offer the most light and wholesome—lightness, and not transparency, the test of purity—purest water distilled from snow on tops of highest mountains—different kinds adapted to different constitutions—very transparent—fresh water at sea putrefies twice, sometimes thrice, in a voyage—a month at sea, sends up a noisome and dangerous vapour, which takes fire from a flame —elementary water not compounded—is ice kept in fusion—dilates in bulk by cold—confirmed by experiments—very compressible and elastic—made to resemble air—a drop of water converted into steam, capable of raising twenty ton weight—keeps its surface level and even—a single quart sufficient to burst a hogshead, and how, i. 137, &c.—water of the sea heavier and more buoyant than fresh water, 202—of the sea, kept sweet by motion, 208—converted into rushing air, and again into its former state, 279.

Water-hen described, iv. 342.

Water-spouts, burst from the sea, and join mists immediately above them, i. 324—most surprising phœnomena, dreadful to mariners, and astonishing to observers of nature, common in the tropical seas, sometimes in our own—description of those seen by Tournefort in the Mediterranean—solutions offered for this surprising phœnomenon, 334—Dr. Franklin's solution of, i. 310.

Water-wagtail, slender-billed bird of the sparrow-kind, living upon insects, iv, 246.

Waves, their luminous appearance in the night, and the cause, i. 207.

Wax, of two kinds, gathered by common bees, vi. 109—the first fifteen days the bees makes more wax than during the rest of the year, 108—that produced by black bees, in tropical climates, only used for medicinal purposes, being too soft for candles, as in Europe, 111.

Weasel, a small carnivorous animal—marks common to the kind—these differ from the cat-kind in the formation and disposition of the claws—differ from the dog-kind in a cloathing of fur rather than hair—one of the species is like all the rest—this the smallest of the whole kind—its description—untameable and untractable—hides and sleeps three parts of the day, and sallies forth for prey in the evening, attacks animals much above its own size—destroys young poultry, and sucks the eggs—so nimbly runs up high walls, no place is secure from it, iii. 68, &c.—catches rats and mice better than cats; also small birds—in cultivated lands it thins the number of hurtful vermin—never cries but when struck—all the kind have glands near the anus, secreting a substance fœtid in some, and a perfume in others—this most offensive in summer, and insufferable when irritated—one sort in America is by sailors called the stinkard—confined to a cage is ever in uneasy agitation—must have leave to hide itself—eats only by stealth, and will not touch the food until it begins to putrefy—the female makes an easy bed for her young, and generally brings forth from three to five at a time, and with closed eyes—account of a weasel's forming her nest, and bringing forth her young, in the putrid carcase of a wolf, 72—the white ermine found in Great Britain is called the white weasel—its fur among us of no value, 80—of the weasel kind, the martin the most pleasing, 87—the boldest and most useful of all is the ichneumon, 94.

Weather, the moist alone prevents evaporation, i. 316.

Weathercocks often erroneous in regard to the currents of air, i. 291.

Weeds, floating over great tracts of the sea, serve as sustenance for many fish bearing similitude with such vegetables, i. 350.

Weever, the trachinus, a prickly-finned jugular fish, its description—the sting given by its back fin is poisonous, v. 122.

Weight (of the human body) often found to differ from itself—instances of it—the difference often amounts to a pound, or sometimes to a pound and an half—not easy to conceive whence this adventitious weight is derived, i. 430—the porters of Constantinople carry burdens of nine hundred pounds weight—a man able to raise a weight of two thousand pounds—a horse will not carry upon its back above two or three hundred pounds—whence this seeming superiority comes, 431.

Well, (burning), at Brosely, now stopped, had a fire-damp in it, which would kindle with the flame of a candle, i. 74—some continue full, affected neither by rains nor droughts, 234.

Wert (Sebald) a traveller, confirms the existence of giants, on

a coast of South America, towards the streights of Magellan, ii, 109.

Whale, the largest animal known; no precise anatomy of this fish yet given—seven different kinds, distinguished by external figure, or internal conformation—are gregarious animals; make migrations from one ocean to another—and generally resort where they have the least disturbauce—great Greenland whale, its description—from sixty to seventy feet long—the head one third of its bulk—its hearing is acute—breathes air at the surface of the water, and cannot remain under it like other fishes—it blows loudly through the spout-holes, and most fiercely when wounded—whalebone different from the bones of the body—the fins are from five to eight feet long—the throat is narrow, nothing larger than a herring can be swallowed—the tail its only weapon of defence, is twenty-four feet broad, and strikes hard blows—one seen by Ray, marbled, with the figures 122 distinctly marked upon it—the flesh palatable to some nations—the female and male keep much together; their fidelity exceeds that of birds—do not cross breeds—she goes with young nine or ten months, is then fatter than at other times—produces two breasts and teats at pleasure—suckles her young a year, and how—is very tender of them—defends them fiercely when pursued—dives with them, and comes up soon to give them breath—during the first year, called short-heads, and then yield fifty barrels of blubber—at two years they are stunts, and after that skull-fish—the food of this animal, an insect called medusa by Linnæus, and walfischaas by the Icelanders—pursues no other fish, and is inoffensive in its element—the whale-louse, of the shell-fish kind, sticks to its body, as to the foul bottom of a ship, gets under the fins, and eats through the skin into the fat—the sword-fish affrights the whale, avoids the stroke of its tail, bounds upon its back, and cuts into it with the toothed edges of its bill—the killer, a cetaceous fish of great strength, with powerful teeth, besets the whale as dogs do a bull, tears it down, and then devours only its tongue—old manner of taking whales—improvements hinted, v. 31, &c.

Whale, (Spermaceti) the cachalot, has teeth in the under jaw—is less than the whale, about sixty feet long, and sixteen high—can remain longer under water and the head makes one half of the whole—is voracious and destructive even to dolphins and porpoises—seven distinctions in this tribe—contain two precious drugs, the spermaceti and ambergris; the latter mostly in older fishes, v. 50. See *Cachalot*.

Wheat-ear, a thick short-billed bird of the sparrow kind, thought foreign, iv. 247—it migrates before winter, 249.

Whin-chat, a slender-billed bird of the sparrow kind, iv. 247—bird of passage, 249.

Whip-snake, a very venomous serpent of the East, is five feet long, and its bite kills in six hours time, v. 369.

Whirlpool, manner in which it is formed, i. 221—those of the ocean particularly dangerous, 223—the central point always lowest, and why, 172.

Whirlwind, the most rapid formed by united contributions of minerals, vegetables, and animals, increasing the current of air, i. 280.

Whiskers, a man without them formerly considered as unfit for company in Spain; nature denying, art supplied the deficiency—a Spanish general borrowing money from the Venetians, pawned his whiskers, and took care to release them—part of the religion of the Tartars consists in the management of their whiskers; and they waged war with the Persians, as infidels, whose whiskers had not the orthodox cut—the kings of Persia wore them matted with gold thread; and the kings of France, of the first races, had them knotted and buttoned with gold, i. 419.

Whiston, his reasoning concerning the theory of the earth—finds water enough in the tail of a comet for the universal deluge, i. 21.

White, the natural colour of men, all other tints proceed from greater or lesser heat of climates, ii. 87—among white races of people, our own country bids fairest for pre-eminence, 89.

White-ants, an extraordinary community, described, vi. 139.

White-bait, shoals appear near Greenwich in July, and seem the young of some animal not come to perfect form, v. 146.

White-nose, the *moustoc*, monkey of the ancient continent, a beautiful little animal—its description—a native of the Gold Coast, iii. 313.

White-throat, a slender billed bird of the sparrow-kind, living upon insects, iv. 247.

Widgeon, a variety of the European duck, described, but best known by its whistling sound, iv. 411.

Wild man of the woods, the *ouran-autang*, foremost of the ape-kind—this name given to various animals walking upright, but from different countries, and of different proportions and powers—the *troglodyte* of Bontius, the *drill* of Purchas, *pygmy* of Tyson, and *pongo* of Battel, have all this general name, iii. 277.

Wind, a current of air—artificial—causes assigned for the variety, activity, continual change, and uncertain duration of it—in what manner to foretel the certainty of a wind, as the return of an eclipse—to account for variations of wind upon land, not at present expected—recourse to be had to the ocean, and why—in many parts of the world the winds pay stated visits—in some places they blow one way by day, and

another by night; in others, for one half year they go in a direction contrary to their former course; in some places the winds never change—the wind which never varies is the great universal wind, blowing from the east to the west, in all extensive oceans, where the land does not break the general current—the other winds are deviations of its current—many theories to explain the motion of the winds—that of Dr. Lyster—theory of Cartesius—Dr. Halley's more plausible, i. 279.

Winds (trade) blow from the poles towards the equator—were the surface of the globe sea, the winds would be constant, and blow in one direction—various circumstances break its current, and drive it back against its general course, forcing it upon coasts that face the west—want of a true system of trade-winds supplied by an imperfect history of them—north wind prevails during October, November, December, and January, in the Atlantic, under the temperate zone—north wind reigns during the winter of Nova Zembla, and other arctic countries—south wind prevails during July in the Cape de Verde islands—north-west wind blows during September at the Cape of Good Hope—regular winds produced by various causes upon land—ancient Greeks first observed them—in general, wherever a strong current of water, there is a wind to attend it—regular wind produced by the flux and reflux of the sea—winds called *monsoons*—some peculiar to certain coasts—south wind constant upon those of Chili and Peru—other winds particular to various coasts, i. 284.

Winds (at land) puff by intervals, and why—not so at sea—east wind more constant than any other, and generally most powerful—wind blowing one way, and clouds moving another, forerunners of thunder—cause of this surprising appearance remains a secret—from sea, generally moister than those over tracts of land—more boisterous in spring and autumn than at other seasons—their force does not depend upon velocity alone, but also upon density—reflected from sides of mountains and towers, often more powerful than in direct progression—raise sandy deserts in one country, to deposit them upon some other—south winds in summer, so hot in Egypt as almost to stop respiration, and produce epidemic disorders, continuing for any length of time—deadly along the coasts of the Persian Gulph, and of India—assume a visible form, i. 289.

Wind-pipe, in men, has a lump not seen in women, i. 424—makes convolutions within a bird, and is called the labyrinth—this difference obtains in birds seemingly of the same species, iv. 10—strange in the throat of the crane, 296.

Wings (of birds) answer four legs of quadrupeds—their de-

scription—bastard wing, iv. 5—flap of a swan's wing breaks a man's leg; a similar blow from an eagle lays a man dead instantly, 7——of butterflies, distinguish them from flies of other kinds—their number and beautiful colours, vi. 67.

Winter, beginning round the poles, the misty appearance of heat in southern climates is there produced by cold, i. 330.

Wistiti, a monkey of the sagoin kind, remarkable for the tufts of hair upon its face, and its annulated tail, iii. 316.

Wolf, a fierce, strong, cunning, carnivorous quadruped, externally and internally so nearly resembling the dog, they seem modelled alike, yet have a perfect antipathy to each other, iii. 30—principal distinction from the dog is the eye, which opens slantingly upwards in the same direction with the nose, 31—also the tail is long, bushy, hanging lank—the wolf lives about twenty years—is not much with those of his kind, yet hunts in packs with them—quarrelling, they devour each other, 33—is watchful and easily waked—supplied with water, lives four or five days without food, 37—carries off a sheep without touching the ground, and runs with it swifter than the shepherds, his pursuers, 38—smells a carcase at a great distance—leaving the wood, goes out against the wind—particularly fond of human flesh—follows armies, and arrive in numbers upon a field of battle, 39—two or three wolves keep a province for a time in continual alarm—distinguished by huntsmen into young, old, and great wolf—manner of hunting them, 39—the wolf killed, no dogs shew an appetite to enjoy their victory, 39—the flesh so very indifferent, no creature eats it but the kind itself—breathe a most fœtid vapour from their jaws, 43.

Wolf-dog, a beautiful and majestic animal, iii. 19.

Wolf-fish, the anarbicas, its description, v. 126.

Wolverene, a variety of the glutton, iii. 109.

Woman, the body arrives at perfection sooner than in men—the persons of women as complete at twenty as those of men at thirty, i. 406—the bones, cartilages, muscles, and other parts of the body, softer than in men—a woman of sixty has a better chance than a man of that age to live to eighty—women longer in growing old than men, ii. 61—the shoulders narrower, and the neck proportionably longer than in men, i. 428—less apt to become bald than men; Mr. Buffon thinks they never become bald; there are too many instances of the contrary, 411—some continue pregnant a month beyond the usual time—those of Africa deliver themselves, and are well a few hours after, 381—remarkable instance of the power of imagination upon the fœtus, ii. 96—lower eye-lids drawn downwards when with child—the corners of the mouth also—then likewise high-shouldered—circumstances under

which the midwives call them all mouth and eyes, i. 425—in barbarous countries the laborious duties of life thrown upon the women, 399.

Womb, history of the child in the womb, i. 375—of the hare divided into two, as a double organ, one side of which may be filled, while the other remains empty, iii. 120—description of the false womb of the oppossum, 324.

Woodchat, a rapacious bird, third kind of the butcher-bird, iv. 105.

Woodcock, bird of the crane-kind, its dimensions, iv. 332—is a bird of passage—places where it is to be found, 336.

Wood-cock, or *cock of the wood*, of the grouse kind, places which this bird inhabits—how distinguished from other birds of the poultry kind—the delicacy of its flesh—its food and habitation—amorous desires first felt in spring—keeps to the place where he first courts, and continues till the trees have their leaves, and the forest is in bloom—its cry, clapping of wings, and ridiculous postures in this season—during which the females, attending his call, are impregnated; sportsmen use this time to fire at them, and take many while thus tame, though at others it is most timorous and watchful—the female much less than her mate, and so unlike him in plumage, she might be mistaken for another species—number and size of the eggs—she hatches them without the cock; and when obliged to leave them, in quest of food, so covers them with moss or leaves, it is difficult to find them—she is then extremely tame and quiet—keeps her nest, though attempted to be driven away—the young being hatched, they run with agility after the mother, though scarcely disengaged from the shell—their food ant's eggs and wild mountain berries—older, they feed upon tops of hether, and cones of pine-trees—are hardy—the clutching time over, the young males forsake the mother; keep together till spring, when the first genial access sets them at variance for ever—fight each other like game-cocks, and easily fall a prey to the fowler, iv. 155

Wood-louse, its description—has three varieties—where found—how bred—are of use in medicine, v. 426.

Wood-pecker, of this bird are many kinds, and varieties in each—general characteristics—description of the *green wood-pecker*, or *wood-spite*, called the *rain-fowl* in some parts—feeds upon insects, particularly those in hollow or rotting trees—description of its tongue, the instrument for killing and procuring food—want that intestine which anatomists call the cœcum—stratagem used by them to catch ants—in what manner they make nests, and how delicate in the choice—number of eggs—nests in warmer regions of Guinea and Brasil—*little wood-pecker*, called by the natives of Brasil *guiratemga*, iv. 190.

Woods, (in Britain) cut down by the Romans, and for what reason, i. 237.

Woodward, his essay towards a natural history of the earth, detail of it, i. 20.

Wool, the Spanish finer than ours; but in weight not comparable to that of Lincoln or Warwickshire—some Spanish wool required to work up with it, ii. 254—of the pacos, most valuable, and formed into stuffs, not inferior to silk; this manufacture a considerable branch of commerce in South America, iii. 382.

Worms, within the body of the caterpillar, devour its entrails, without destroying its life, vi. 79—of different kinds infest each species of fish, v. 154—*sea-worms* make the shells of fishes their food, v. 212.

Worm, (Blind) of the serpent kind, its description—lies torpid all winter, v. 376.

Worm, (Froth) an insect in that sort of substance on the surface of plants—description of it, vi. 34.

Worm-kind, general description of the *earth-worm*—entirely without brain, but with the heart near the head—in what manner taken—its eggs—nourishment—keeps life in separated parts, vi. 172.

Wrasse, the labrus of the prickly-finned thoracic kind—description of this fish, v. 123.

Wren, and *golden-crowned-wren*, slender-billed birds of the sparrow-kind, iv. 247—*willow-wren*, a wandering bird of the sparrow-kind, 249—the singing-bird admired for the loudness of its note, compared to the smallness of its body, 262.

Wrinkles, whence those of the body and face proceed, ii. 60.

Wry-neck, or *cuckoo's attendant*, a little bird, active in the chase of the young cuckoo, iv. 206.

X.

Xiphias, or the *sword-fish*, of the prickly-finned apodal kind, its description, v. 122.

Y.

Yak, or bushy-tailed-bull of Tibet, described by Capt. Turner, ii. 238.

Yellow-hammer, a small bird of the sparrow-kind, iv. 247.

Young (people) sometimes cease growing at fourteen or fifteen, i. 406.

Z.

Zebra, the most beautiful, but wildest animal—a native of the southern parts of Africa—nothing exceeds the delicate regularity of its colour—description—watchful and swift—its speed a proverb among Spaniards and Portuguese—stands better upon its legs than a horse—in what countries found—the Portuguese pretend to have tamed, and sent four from Africa to Lisbon, to draw the king's coach—some sent to Brasil could not be tamed—Merolla asserts, when tamed, they are still as estimable for swiftness as beauty—their noise resembles the confused barking of a mastiff dog—in two, the author saw the skin below the jaw upon the neck hang loose in a kind of dewlap—they are easily fed; some in England eat bread, meat, and tobacco—the emperor of Japan made a present of sixty thousand crowns value, for one received from a governor of Batavia—the Great Mogul gave two thousand ducats for another—African ambassadors to the Court of Constantinople bring some with them as presents for the Grand Seignior, ii. 209, &c.

Zebu, the *Barbary-cow*, and the *grunting* or *Siberian-cow*, are but different races of the *bison*, ii, 236, 224.

Zeiran, name of the fourth variety of gazelles by Mr. Buffon, ii. 280.

Zenic, a kind of weasel, described by M. Sonnerat, iii. 115.

Zeus, the *doree*, of the prickly-finned thoracic kind, description of that fish, v. 125.

Zibet, one of the two species of the civet, according to Mr. Buffon—distinction between them, iii. 104.

Zone, (temperate) properly speaking the theatre of natural history, i. 11.

Zone, (torrid) in the centre the heat very tolerable, in other places the cold painful—temperature and advantages of perpetual spring under it, i. 125—lightning there not fatal or dangerous, 325—has the largest quadrupeds—all fond of the water, ii. 241.

Zoophytes, name of vegetable nature endued with animal life, vi. 169—first class of zoophytes, 172—all the tribe continue to live in separate parts; one animal, by cuttings, divided into two distinct existences, sometimes into a thousand, 175—second class, 180.

Zorille, a stinkard, of the weasel-kind—resembles the skink—is smaller and more beautifully coloured, iii. 98.

THE END.

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